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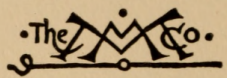

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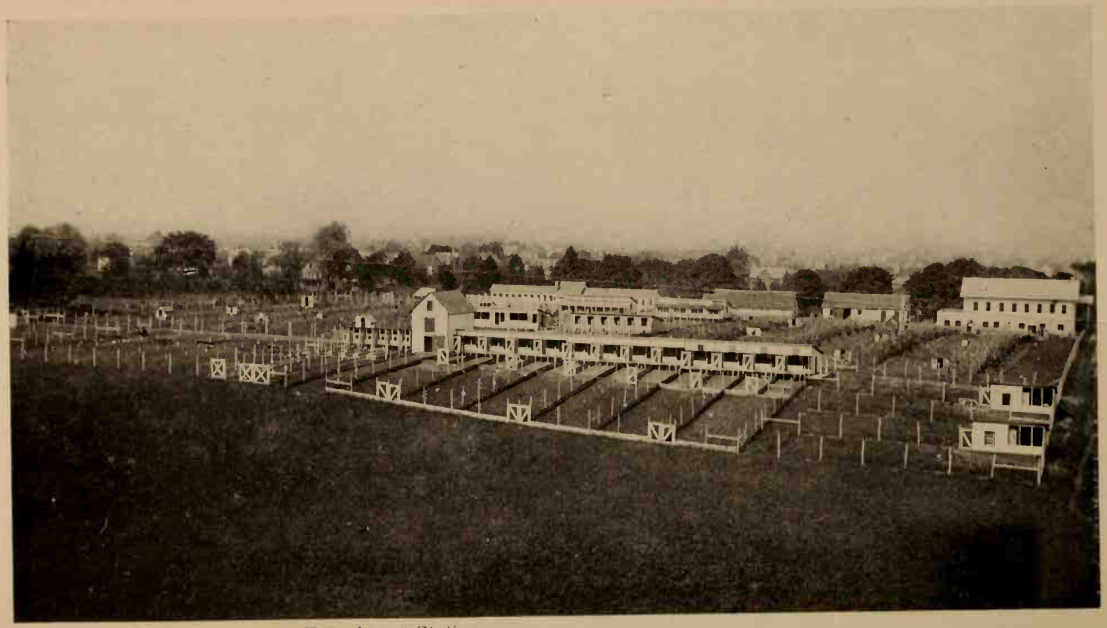

Courtesy N. J. Agricultural Experiment Station

A commercial poultry plant located on a southern slope and situated on the outskirts of a small city . . . wonderfully located as to production and marketing facilities

Popular Poultry Pointers

A Book of Popular Up-to-Date Recommendations That Have Proved Successful on Many Farms

BY

RALSTON R. HANNAS, M.Sc.,

Superintendent of Egg Laying Contests in New Jersey; formerly Head of Poultry Department at the Red Cross Institute for the Blind, Baltimore, Md.

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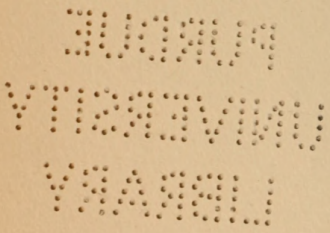

VAIL-BALLOU COMPANY
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To the Memory of

MY FATHER

whose untiring interest in his work

has been a guide to me

this book is affectionately dedicated

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PREFACE

It is the purpose of this book to instruct and entertain. The various chapters have been written in such a way, therefore, as to give the most up-to-date information possible concerning the different phases of poultry raising in a manner that will make the reading thereof a pleasure, with no unpleasant interruptions or ponderings over vague scientific words. I sincerely trust the endeavor has been successful.

Nearly all the chapters in this book have been published in *The Country Gentleman* as popular articles. One of them appeared in *The Rural New Yorker*. They have been arranged in order and enough extra chapters have been written to form the basis for an outline of a year's work for a poultry keeper, beginning with the choice of a breed and continuing with the lay-out of the farm, the housing of the birds, feeding and care of birds to obtain maximum egg production, and the marketing of the eggs, as well as the selection of breeders, incubation and brooding of the chicks, and sanitation of the flock, concluding with a summary of the financial side of the business. It is hoped, also, that the appendix will be found to be helpful.

PREFACE

Doubtless all who read this book are lovers of poultry—else they would not have come in contact with the book at all. Assuming this to be the case, then, I wish to take this opportunity to urge upon all true lovers of poultry who read this the improvement of the Great American Hen, regardless of breed, variety, and location. The quality of our farm flocks, our commercial flocks, and our suburban flocks may be improved greatly. We can each do our share. It is the hope of the author that the few suggestions which are given in the pages that follow may prove of benefit to many and may have a small share, at least, in bringing about this desired result.

RALSTON R. HANNAS.

New Brunswick, New Jersey,
April 22, 1922.

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POPULAR POULTRY POINTERS

CHAPTER 1

CHOOSING A BREED

One of the first things one is called upon to do in establishing a flock of chickens is to choose the breed of fowl he wishes to keep. This may be an easy thing to do or it may be difficult, depending upon how much previous experience the person in question may have had or how much he has read on the subject or who has been talking to him. I mention the last because there are many who have just about made up their minds to establish themselves with a certain breed and have happened to meet a loyal supporter of an entirely different kind of breed who was a good talker. The result has been that the plans have been changed, probably contrary to best convictions or desire, simply because of the lack of a good talking point.

All breeds have their good "talking points."

In general, however, there are two factors a man should consider when he is about to select a breed or a variety within a breed: these are the purpose for which he wants the birds and his personal likes and dislikes for the various breeds and varieties. For example, if he wanted to raise chickens purely for the meat, not caring a great deal for the eggs except for breeding purposes and for a fresh egg to eat now and then, he would be foolish to try to start with Leghorns no matter how much he liked them. On the other hand, if he wanted to raise poultry for meat, and had a choice between Black Giants and Brahmas, it would be merely a matter of personal choice; he would do ever so much better with his chickens as a whole if he liked the Giants and started with them than if he liked the Giants but persuaded himself that he ought to keep the Brahmas merely because someone else talked him into it. Get the point?

The breeds of poultry may roughly be divided into three groups: meat breeds, egg breeds, and general purpose breeds. The meat breeds, as the name implies, include those breeds that naturally grow to be heavy, large framed birds. They are of a sluggish disposition, exercising little, and go only a short distance from the house in search of food. In other words, they are "poor rustlers." Since these characteristics are conducive to rapid growth of body framework and rapid gain

Plate I. A Barred Plymouth Rock—Female

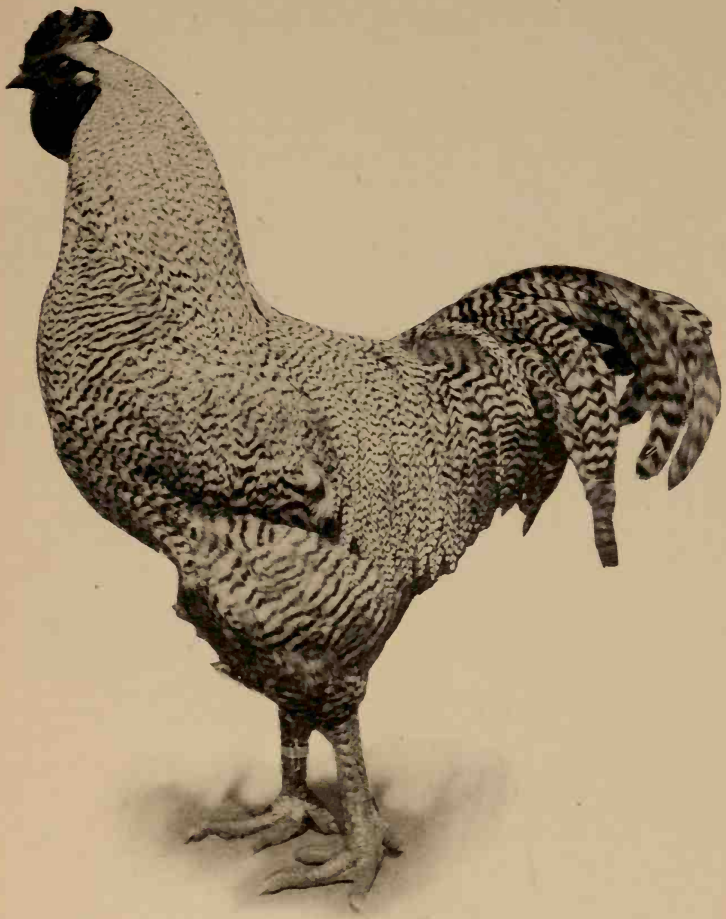


Plate II. A Barred Plymouth Rock—Male

in weight, they are ideal for the purpose of producing meat.

The egg breeds are the exact opposites of the meat breeds in nearly every respect: they are small, having a small body framework and seldom weighing more than four pounds. They are of a nervous disposition, exercise freely, and are good "rustlers," going quite a distance from their quarters in search of food. For the weight of the product—which is several times their own bodyweight—and for the amount of feed consumed, they are probably the most efficient class of birds of the three groups. The carcasses of these birds are, of course, suitable for consumption, but are not popular with many because of the small weight. This factor, on the other hand, gives them a steadily growing popularity in many sections, as there are a number of small families that want a chicken for Sunday dinner and Sunday night supper and do not want it to hang over for several days. Many claim that the quality of the meat is not so good as in the case of the heavier birds, but I have not found this to be so.

The so-called general purpose breeds stand midway between the meat and egg types in practically all respects. They are medium in weight, are not so flighty as the egg types, inclining more towards the heavy breeds in disposition, laying a good many eggs and producing a medium heavy

carcass. Indeed, these birds included in this group are quite frequently referred to, when contrasted with the egg breeds, as heavy breeds. For the ordinary farm flock, or backyard flock, this group of birds is undoubtedly the "best bet," for they produce a large number of eggs and provide a good-sized carcass for eating purposes. For specialized poultry farming, however, a different choice may be desirable.

Below is given a list of the various breeds included under each of the groups mentioned above. Only the most common breeds are given and no attempt has been made to include every breed mentioned in the American Standard of Perfection as published by the American Poultry Association.

Meat Breeds	Egg Breeds	General Purpose Breeds
Brahmas	Leghorns	Plymouth Rocks
Cochins	Anconas	Wyandottes
Langshans	Minorcas	Rhode Island Reds
Jersey Black Giants	Campines	Orpingtons
	Houdans	

There is still another class of birds that might be considered to have a slight commercial value and that class is known as the Fancy Breeds. It is composed of the Silkies, Sultans, Frizzles, and Bantams. These breeds are bred for fancy or ornamental purposes—mainly for exhibition purposes. Their commercial value is questionable, except where there is a ready sale for birds of this

Plate III. A Rhode Island Red—Female

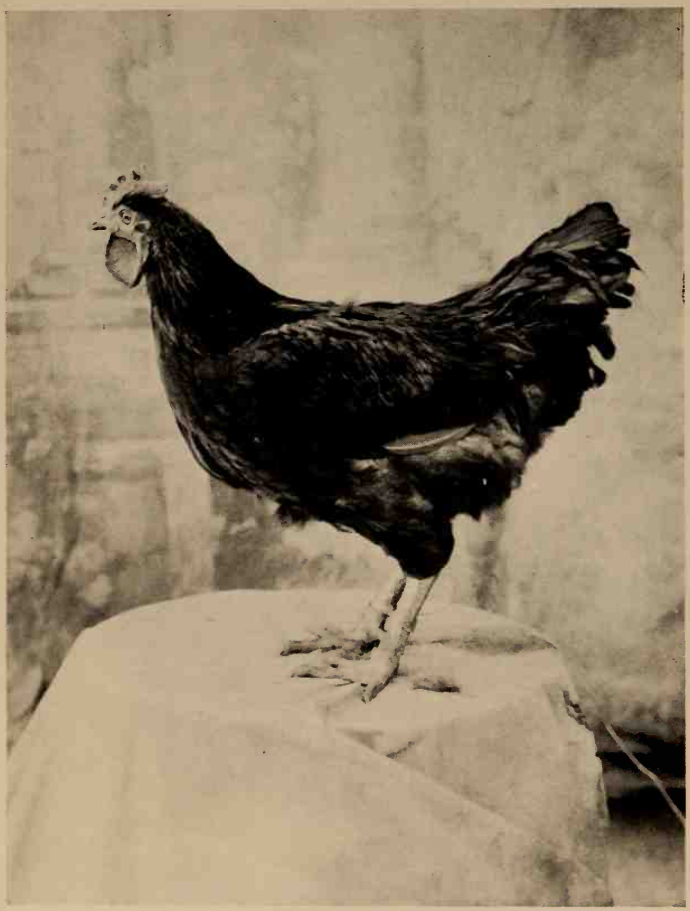


Plate IV. A Rhode Island Red—Male

type. As may be supposed, the market for such birds is limited.

Of the real meat breeds, perhaps the Brahmas are the most popular. There are two varieties, the Light and the Dark, and of these the Light are far more common. Their popularity may be due to the fact that they will probably lay more eggs than the other breeds in this group—I suppose because there are more of them raised in this country and the egg-producing quality has had a better chance to be bred into them. They have feathered shanks and are heavily feathered all over, making them adaptable to cold climates. Males will weigh from ten to twelve pounds and females eight to nine and a half pounds.

The Jersey Black Giant, a breed which is rapidly gaining in popularity—especially in its native state, New Jersey—is a beautiful bird, black in color, as its name implies, with a greenish sheen. It is claimed for this breed that it will lay a large number of eggs in addition to producing large quantities of meat. The weights are about the same for this breed as for the Brahmas, although they may run a trifle higher. Indeed, capons from this breed will weigh as high as fifteen pounds.

For egg producers, there's no doubt but that the Leghorn takes the prize. I'll have more to say about this very popular breed in a money-making way in the next chapter; suffice it to say

here, however, that this small bird, weighing from three and a half to four pounds is the queen of them all when it comes to laying eggs. The White Leghorn seems to be the best liked variety. Other varieties of this breed are Brown, Black, Buff, Silver, and Red Pyle, the last two being very little seen. All but the last two appear either as Rose Comb or Single Comb varieties.

The Single Comb Anconas with their black and white plumage make very attractive birds and are good layers. The Single Comb Black Minorcas are the heaviest of these egg breeds, the females weighing from six and a half to seven and a half pounds and the males from seven and a half to nine pounds. They also have the distinction of laying the largest eggs of any of the egg breeds. There are a number of strains or families of Leghorns, however, that will give them a race for this honor, but it is not to be denied that the Minorcas do lay a fine large white egg. As a matter of fact, all the breeds listed here as egg breeds lay white-shelled eggs, but it is characteristic of the Minorcas that their eggs are larger, as a breed, than the eggs of other breeds. This characteristic means a great deal when a high class white egg market is catered to, as the New York market. The Campines and Houdans are not quite so popular as the breeds already mentioned, but the former seems to be gaining in popularity in this country.

Plate V. A White Wyandotte—Female

Plate VI. A White Wyandotte—Male

Plate VII. A Single Comb White Leghorn—Male

Plate VIII. A Single Comb White Leghorn—Female

Of the general purpose breeds, the Plymouth Rocks, Wyandottes, and Rhode Island Reds may be said to be "America's Own," for they are purely American breeds and are known as such in the Standard of Perfection just referred to. Of all these, I suppose the Plymouth Rocks are the most popular, and within this breed there is no doubt but that the Barred variety leads all others. The females range from six pounds to seven and a half pounds and the males from eight to nine and a half pounds. They have been bred so long that they have had the egg-laying qualities bred into them, as well as a good quality of flesh. They have the characteristic yellow skin and shanks of all the American breeds, as contrasted with the white skin and shanks of the English breeds, of which the Orpingtons are examples. The American taste in poultry meat runs to a yellow flesh, while the English taste runs to a white flesh. Next to the Barred Plymouth Rock, the White variety is the most popular of this breed.

The White Wyandotte leads in favor in this breed. The weights here are from one half pound to a pound lighter than in the case of the Plymouth Rocks. This breed also has the disadvantage of laying smaller eggs than those already mentioned. The eggs are brown, as are all the eggs from the breeds in this general purpose class. This breed is noted for its egg-producing ability,

having won distinction at a number of egg laying contests, both in this country and abroad.

The Rhode Island Reds are distinctly New England birds and are most beautiful when the proper color is obtained. They are about between the Rocks and the Wyandottes as to weight, are heavy layers, and lay fine large brown eggs. Their good qualities seem to be attracting the eye of the public, for there is always a great demand for hatching eggs and stock for this particular breed.

The Orpingtons are not so popular in this country as in England, for the reasons given above. The matter of color of skin as being correlated to taste is all in the way one looks at it, but I suppose it is this one factor alone which makes this breed popular in one country and not in another. They are heavy birds—about like the Rocks—and are excellent layers. They have given satisfaction to a number of poultry keepers.

As I remarked at the beginning of this chapter, the whole matter of choosing a breed is largely one of personal preference: what a person likes is what he's going to make the best success with, and it's up to him to pick out his own breed. So go to it, Mr. Poultryman, make your own choice and stick to it!

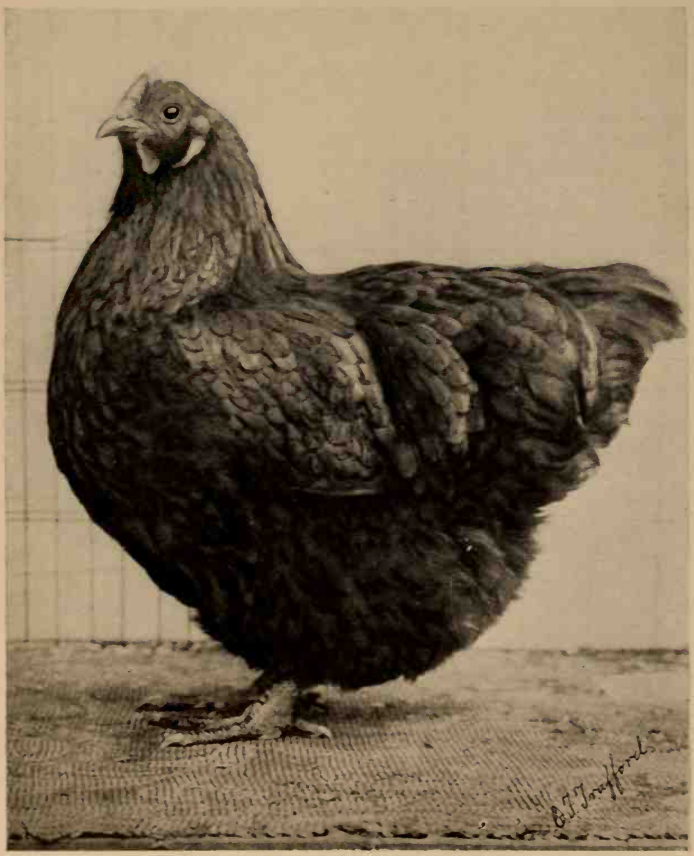


Plate IX. A Buff Orpington—Female

Plate X. A Light Brahma—Female

CHAPTER II

A LEGHORN JAMBOREE

"If you were to start in the poultry business, which breed of chickens would you keep?" I have been asked many times. Now, if I were a commercial poultryman, depending upon the raising of chickens for a living, I would say one thing; if I were a general farmer, expecting to raise poultry as a profitable sideline, I would probably say another thing; if I were a fancier, looking more to the showroom end of the game, I would say still another thing; while if I were to raise chickens just as a hobby, I would be apt to say most anything.

However, being in a position where I see the records daily of large commercial flocks, farm flocks, backyard flocks, and experimental flocks, I cannot help but feel that there is one breed that with proper selection, proper breeding, and proper care will deliver the goods with interest. That breed is the Leghorn. And the variety I would recommend is the White Leghorn.

Mighty Profitable Birds

"What, those sparrows?" you may ask. Yes, indeed, those sparrows, as they are referred to

by many general farmers. But no matter how they are referred to, they are mighty profitable birds, as many Jersey poultrymen can testify. What is the secret of their popularity? Why is it that such small, nervous, flighty birds are raised by hundreds of poultrymen of the East—men who rely upon chickens for their entire living? There are a number of reasons why this breed is so profitable, three of which stand out prominently. They are: An increased production over the other breeds, a decreased feed consumption as compared with the heavier breeds, and, in the East, an increased selling price for the white eggs over that of the brown eggs produced by the heavier breeds.

Let us get down to brass tacks and actually see how the Leghorns surpass the other breeds as money-getters from actual records. It is generally conceded that figures do not lie, while on the other hand it is a well-known fact that liars do figure. However, the figures that follow are actual records obtained at the New Jersey Agricultural Experiment Station and will be shown upon request to anyone who asks to see them. They were obtained from a flock of 1000 birds, 170 of which were Plymouth Rocks, 150 of which were Wyandottes, 80 of which were Rhode Island Reds, and the remaining 600 were Leghorns. In the table which follows, the first column represents the production per bird for the first or pul-

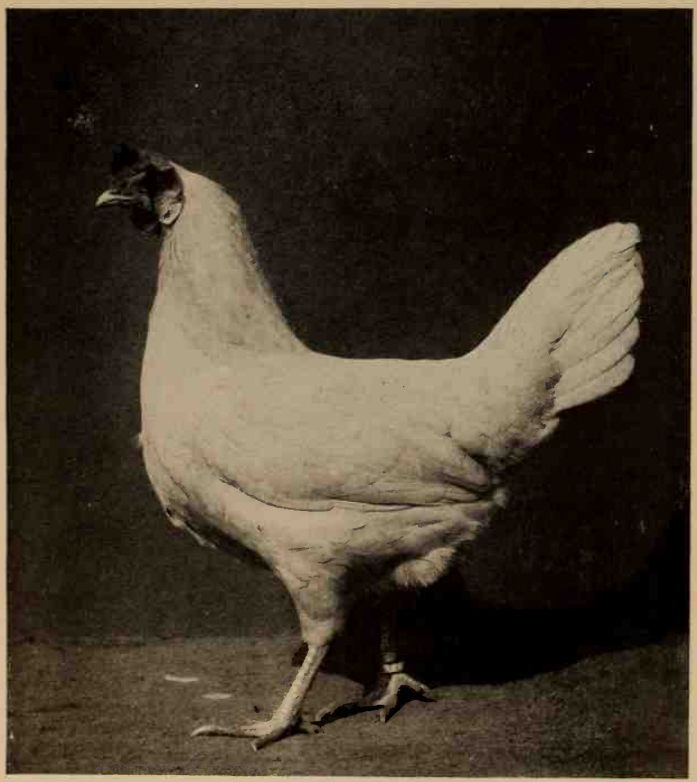


Plate XI. A White Leghorn with a four-year record of more than 650 eggs

let year; the second column shows the production during the second or yearling year; and the third column records the production of daughters of the four breeds recorded in the first two years.

A glance at the table quickly shows that the Leghorns lay from fifteen to nineteen eggs apiece more than the next highest breed, the Plymouth Rocks. What does this mean in cold cash? With an average of seventeen eggs a bird at an average selling price of sixty-two cents a dozen, as they were last year, this means a receipt of nearly one dollar a bird more from a Leghorn than from a Plymouth Rock. See what this means in a flock of one hundred birds. A bull's-eye for the Leghorns right off the reel! But more of profits a little later. Here is the table:

	Production per Bird		
Breed	Pullet Year	Yearling Year	Pullet Year
Plymouth Rocks	155	119	169
Wyandottes	144	115	158
Rhode Island Reds	151	117	164
Leghorns	170	138	188

Now about the feeding question—a very important one. I said a little while back that the Leghorn ate less than the heavier breeds, and I shall prove it. The following table, arranged similarly to the preceding one, shows the amount of feed consumed per bird in a year:

	Pounds of Feed Consumed per Bird		
Breed	Pullet Year	Yearling Year	Pullet Year
Plymouth Rocks	89.8	88.6	89.7
Wyandottes	80.3	80.4	82.0
Rhode Island Reds	86.6	86.5	91.3
Leghorns	76.2	79.9	80.3

Just glance at those figures and see what they show. The first pullet year the sparrows consumed only 4.1 pounds of feed a bird less than the Wyandottes; the yearling year only one-half pound less, and the third year—pullet year—only 1.7 pounds less. But look what they were doing while they were eating less: They were laying twenty-six eggs a bird more the first year, twenty-three eggs more the second year, and thirty eggs more a bird the third (pullet) year. In comparison with the Plymouth Rocks, which laid the most of any of the other breeds, the Leghorns ate 13.6 pounds less feed the first pullet year, 8.7 pounds less the yearling year, and 9.4 pounds the second pullet year. Of course, the fact that they ate less, in itself, is not so great, as they are smaller birds —although feed has been known to be high; but they laid more while they were doing it.

The White Egg Premium

The average actual price received during the past five years for brown and white eggs is shown below. Since the Rocks, Wyandottes, and Reds all lay brown eggs, they are classed below as the

heavy breeds, as contrasted with the Leghorns, which lay white eggs. The years in this table, as in the others, are figured from November first to November first. The prices quoted were taken from *The Producer's Price Current,* which gives the quotations on the New York Mercantile Exchange:

	Egg Prices a Dozen				
Breed	1916–17	1917–18	1918–19	1919–20	1920–21
Heavy Breeds	.43	.46	.575	.647	.538
Leghorns	.46	.522	.647	.74	.616

This third factor in favor of the Leghorns, which probably is not of much importance as affecting profits in the West or Middle West—except, of course, in the Petaluma district of California—means several thousand dollars each year to the egg producers of the East. The premium paid for white-shell eggs over brown-shell eggs ranges during the year from two to eighteen or twenty cents a dozen and is due to the demand for high class white eggs. The Jewish trade, especially, demands white eggs and is willing to pay the premium. It can readily be seen that the white eggs bring on an average of five or six cents a dozen more the year round than do the brown eggs—a tidy little difference. The Leghorns not only have the advantage as to production and consumption, but also as to marketing. They get 'em going and coming.

We have discussed briefly three of the factors which go far towards determining whether or not a chicken is profitable. Let us now summarize these figures and show what the actual profit above feed cost was for the one thousand birds studied. The accompanying tables show the amount and cost of feed consumed a bird, the number of eggs produced a bird, the average price a dozen eggs, the value of eggs a bird, and profit a bird over cost of feed for each breed. It must be explained here that prices for 1916, 1917, and 1918 were used, as this was the time when both feed and egg prices were on the incline. As feed prices dropped sooner than egg prices, it was deemed unwise to use the figures for the later years, especially 1920–21, for it was felt that the large profits obtained would be misleading. The figures that are given, therefore, may safely be taken as guides to show the relative profitableness of the breeds, but it must be understood that from now on both feed prices and egg prices will be lower than those indicated here.

	Plymouth Rocks		
	Pullet Year	Yearling Year	Pullet Year
Pounds feed consumed	89.8	88.6	89.7
Cost of feed	$ 2.52	$ 3.19	$ 3.37
Number eggs produced	155	119	169
Average price a dozen	$ 0.43	$ 0.46	$ 0.575
Value of eggs produced	$ 5.46	$ 4.58	$ 8.11
Profit above feed cost	$ 2.94	$ 1.39	$ 4.74

Wyandottes

	Pullet Year	Yearling Year	Pullet Year
Pounds feed consumed	80.3	80.4	82.0
Cost of feed	$ 2.30	$ 2.93	$ 3.13
Number eggs produced	144	115	158
Average price a dozen	$ 0.43	$ 0.46	$ 0.575
Value of eggs produced	$ 5.22	$ 4.44	$ 7.59
Profit above feed cost	$ 2.92	$ 1.51	$ 4.46

Rhode Island Reds

	Pullet Year	Yearling Year	Pullet Year
Pounds feed consumed	86.6	86.5	91.3
Cost of feed	$ 2.47	$ 3.04	$ 3.47
Number eggs produced	151	117	164
Average price a dozen	$ 0.43	$ 0.46	$ 0.575
Value of eggs produced	$ 5.44	$ 4.54	$ 7.88
Profit above feed cost	$ 2.97	$ 1.50	$ 4.41

Leghorns

	Pullet Year	Yearling Year	Pullet Year
Pounds feed consumed	76.2	79.9	80.3
Cost of feed	$ 2.19	$ 2.87	$ 2.88
Number eggs produced	170	138	188
Average price a dozen	$ 0.46	$ 0.522	$ 0.647
Value of eggs produced	$ 6.49	$ 5.98	$10.14
Profit above feed cost	$ 4.30	$ 3.11	$ 7.26

As to the profits a bird for each breed, they may be seen in the following table:

	Pullet Year	Yearling Year	Pullet Year
Plymouth Rocks	$2.94	$1.39	$4.74
Wyandottes	2.92	1.51	4.46
Rhode Island Reds	2.97	1.50	4.41
Leghorns	4.30	3.11	7.26

A dollar and a half may be deducted from each of these profits to account for labor, depreciation, and interest on investment. There surely ought to be no doubt as to superiority of the Leghorn as a money-maker from a glance at the above figures.

Supposing we sell the birds as soon as they stop laying in the summer. The Leghorns at that time will average 3.5 pounds apiece and the heavy breeds not quite six pounds apiece. Let us allow thirty cents a pound for the Leghorns and thirty-five for the other breeds. This makes $1.05 a Leghorn and $2.10 a heavy breed, or a difference of $1.05 in favor of each heavy breed. Add this to any of the above profits and you still have a difference varying from twenty-eight cents to $1.80 a bird, depending upon which you add to, in favor of the Leghorn.

More Leghorns can be kept in a given area than any of the heavy breeds.

Another advantage is the greater fertility and hatchability of Leghorn eggs, as a rule, than Rock, Red, or Wyandotte eggs. Greater livability of chicks, as a rule, is obtained with Leghorns than with heavier breeds.

The broody records on the flocks cited above showed that 400 birds—Rocks, Reds and Wyandottes—were five times as broody as 600 Leghorns, and lost 7,871 days in a year against 912 days for the sparrows.

I have not meant to cast any slur on any of the

other breeds with which I have compared the Leghorns; they are all fine birds and have their place in poultry raising, as has any other breed of fowl. For capon and roaster production the heavy breeds are there, but I would like to be shown how they are more profitable or, indeed, as profitable as the Leghorns. The heavy breeds make good fillers in. They help to maintain an even production and a uniform income. There should be some heavy breeds on every farm, but for the bulk of the income count on the Leghorns. They're some chickens.

CHAPTER III

LAYING OUT A POULTRY PLANT

"How large should I make my chicken runs, and where should I locate them?" These are common questions, yet ones which seem to puzzle many keepers.

There is nothing very difficult about any of these items—least of all the size of the yard or run. Of far more importance are the size and location of the house itself. The house should be large enough or the flock small enough, so that the birds are not crowded. Good results are difficult to obtain where crowded conditions exist. A good rule to follow in fitting the house to the birds or the birds to the house, is to allow at least four square feet of floor space to each bird when Leghorns or any light breeds are kept, and five square feet for the heavier birds. The following table will give some idea as to the possible and desirable capacity for various sized houses:

Dimensions	Area	Actual Capacity		Real Comfort	
		Small	Large	Small	Large
Feet	Sq. Feet	Fowls	Fowls	Fowls	Fowls
6 x 8	48	12	9	10	7
8 x 10	80	20	16	20	15

Dimensions	Area	Actual Capacity		Real Comfort	
		Small	Large	Small	Large
Feet	Sq. Feet	Fowls	Fowls	Fowls	Fowls
10 x 12	120	30	24	30	22
12 x 14	168	42	33	40	30
14 x 16	224	56	44	55	40
18 x 20	360	90	72	90	70
20 x 20	400	100	80	100	80

The column headed Actual Capacity is divided into two parts. The first part relates to Leghorns and the second to the heavier breeds. The next column, Real Comfort, is likewise divided and shows the number—with some to spare—that may be kept, without any doubt as to safety, in buildings of the sizes given. More than sufficient room is figured in this case.

A relatively high spot is the best location for a house, because this eliminates the possibility of water collecting in large quantities around the house and creating damp, unhealthful conditions. Face the house to the south, and you're all set.

Convenience and efficiency go hand in hand. Therefore, to have things efficient they must be convenient. A centrally located feed room will do much to save steps, as will also laying houses that are not far from the dwelling house. Where much incubating is done as well as brooding, these buildings ought to be located near the dwelling, as it is often necessary to visit them during the night. Range houses may be placed farther from the dwelling, in a spot rich in greens and undergrowth

—or in an orchard, for that matter. In regard to the latter point, however, peach trees do not do so well with poultry as do other kinds of fruit trees, owing to the rank growth resulting from the rich manure. A point which should also receive considerable attention in the selection of a range is a location of a stream of water. In general, it is wise to group young stock houses (range houses) along such a stream for two reasons: first, because this, as a rule, insures a constant supply of green food for the growing birds, and second, because much time and labor can be saved by not having to water the stock several times a day.

Quite frequently in laying out a poultry plant too much land is given to roads. Have only roads that are necessary. The manure shed, essential for the storage of this valuable by-product, should be handy to both the laying houses and the land reserved for crops, but far enough away from the residence not to be offensive.

Health the First Consideration

To give birds absolutely as much space as they will need, 150 square feet of yard space for each fowl may be allowed. Yet this may be reduced to fit individual conditions—twenty-five square feet a bird only may be allowed if a system of double yarding is followed. If the double yarding is practiced, all the yard may be in the front of

Plate XII. Showing arrangement of small houses at the Vineland International Egg Laying and breeding Contest, each house with its own y ard. Lanes in back of each row of houses provide for entrance to the houses

the house and this yard divided in two, having a crop growing in the one while the birds are running in the other. When this second yard is cleaned of green food and the grain is high enough in the first yard so that it is suitable for grazing, the birds may be changed from the one to the other. Or, if it is desirable to give the birds a large yard in front, another may be had in the rear and the front and rear yards may be alternated. The following crop rotation may be used, in general, in the northern part of the United States, or in sections where the growing season is not very long:

Yard A	Yard B
April 1—Oats and peas.	Birds feeding on fall planted crop.
June 1—Birds feeding.	Buckwheat.
Aug 1—Soy beans.	Birds feeding.
Oct. 1—Birds feeding.	Wheat and rye.

The above dates may vary two weeks either way, depending upon weather conditions and climate. This second rotation is a more complicated one and one that is suitable for a section where the growing season is a long one, or, in general, a southern climate.

Yard A	Yard B
Mar. 25–Apr. 30—Oats and peas.	Birds feeding.
Apr. 30–May 25—Birds feeding.	Peas and barley.
May 25–June 15—Dwarf Essex rape.	Birds feeding.
June 15–July 10—Birds feeding.	Oats and buckwheat.
July 10–Aug. 1—Buckwheat.	Birds feeding.

Yard A	Yard B
Aug. 1–Aug. 20—Birds feeding.	Cowpeas or soy beans and millet.
Aug. 20–Sept. 20—Rye, vetch, crimson clover.	Birds feeding.
Sept. 20–Dec. 1—Birds feeding.	Rye, vetch, crimson clover.

The crops need only be three or four inches high —just so the birds can get some green food. This latter double yarding schedule requires quite a little labor.

Nevertheless, birds may be kept shut in the houses all the time with fair results as far as egg production is concerned. On some poultry farms they are shut in from November until June. When such a system is followed, great care must be taken to keep the birds in the best of physical condition by the use of Epsom salts and green or succulent feeds. Breeders should never be shut in or their yard space restricted except during the winter months, and then for only as short a time as possible. Best results can generally be expected from the largest amount of runway it is possible to give. If you can't keep the birds in good condition as a result of restricting the yard space, by all means relieve conditions by either increasing the size of the yards or decreasing the size of the flock. Health above all things is desirable.

The accompanying maps will give some idea as to the way in which poultry plants of different sizes are laid out. The larger plant of five acres

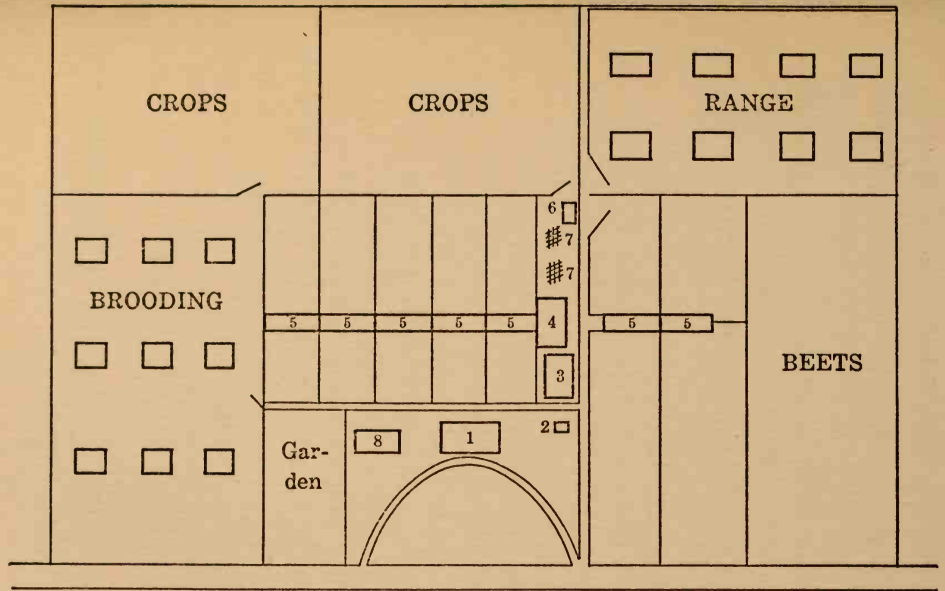


Fig. 1. A suggested layout for a five acre, one-man, commercial plant. As shown in the diagram, the plant will accommodate 700 adult birds and can be made to accommodate 1500 or 1600 easily; extra help necessary in the brooding season.

is typical of the many one-man units in the commercial poultry sections of the East. The smaller plant, of two acres, may be taken as a guide for a similar sized plant or smaller; this is typical of

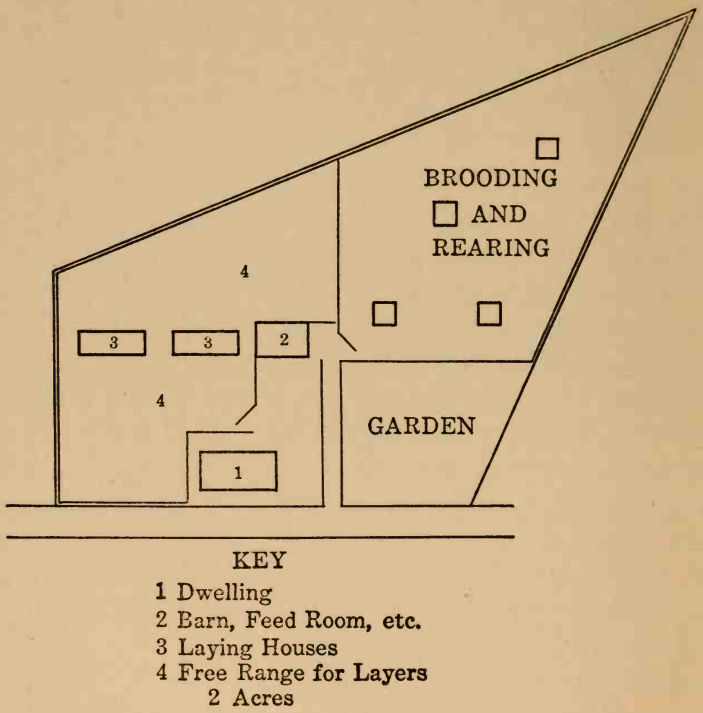


Fig. 2. A suggested layout for a two acre place accommodating 200 adult birds as shown, but capable of being enlarged to accommodate 400 or 500.

many small farm flocks. The suburbanite may also use this as a guide in increasing the size of

his plant, as he seldom has more land at his disposal than this. On both these plants, poultry raisers must be cautioned against brooding on the same ground for a number of years; where possible alternate brooding and cropping after three or four years. Such graphic representations will give a clearer idea as to the way in which poultry plants are laid out than several chapters of written material.

CHAPTER IV

HOUSING THE LAYERS

"Do you know," Judson remarked to me the other day, "Smith's hen house is never damp and foul smelling as mine is, and I can't understand it—my house is tight and there's no chance for the wind to blow in on the birds." "No, Judson," I replied, "and there's no chance for sunlight, fresh air, or anything else to get in there either." I then gave him a lecture on laying houses, and by the time I got through, he saw that his house with few openings in it was unsanitary, and did not give the hens the proper amount of light and fresh air that they needed.

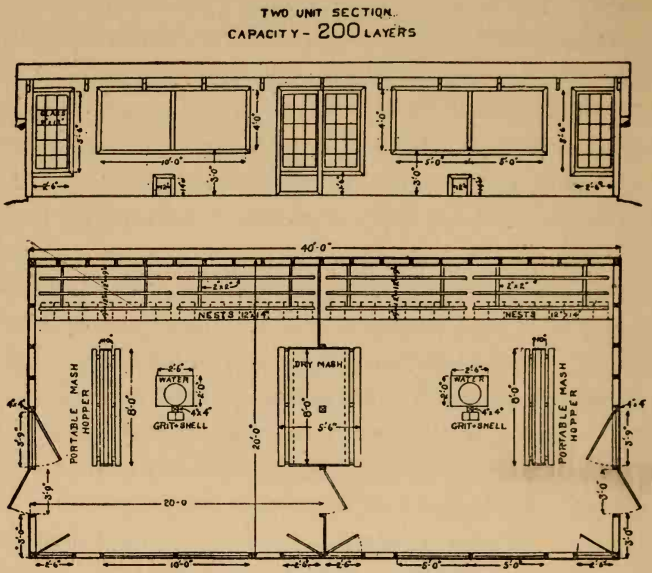
There are certain principles which must be considered in building a poultry house, no matter what type or style is used. The birds must have plenty of room—at least four square feet of floor space per bird. I have discussed this in a previous chapter and therefore will not say any more about it here. Aside from supplying the birds with plenty of room, the house must provide for plenty of ventilation, must provide plenty of openings so that sunlight may enter the house freely, and in addition to all this the house must be dry

at all times. Practically all these factors may be obtained in the same way, namely, by having sufficient openings in the front of the house—some glass windows and some openings which are kept open nearly all the time except for real cold weather or stormy weather, when they may be closed by means of muslin curtains. All these factors are easily obtained, as the openings permit of the entrance of light and air and these, in turn, aid in maintaining dryness. Dryness is further assured by having the openings far enough above the floor so that the rain will not beat in any more than can be helped and dampen the litter.

The house which I am about to describe and for which plans are shown has been found very satisfactory for the conditions which obtain in New Jersey. This style of house is recommended by the New Jersey Agricultural Experiment Station for conditions in that state, and there is no reason why it would not be practical in other states where conditions are about the same as those in New Jersey. Indeed, this house has been used farther north with very good results. The interior arrangements, at any rate, may be used, even though the size and number of openings may be changed somewhat to meet more severe weather.

The house in question is of the shed roof type; in size it is 20′ x 20′ for 100 birds. This is taken as a unit and any number of units desired may be built; for example the house shown here is a dou-

ble unit house, housing two hundred birds. The house is so designed that any number of units may



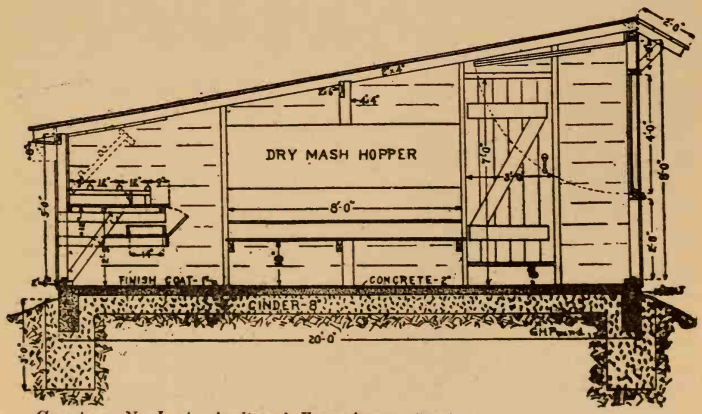
Courtesy N. J. Agricultural Experiment Station.

Fig 3. Front and floor plans of a double unit 20′x40′ laying house to accommodate 200 layers.

be added without spoiling the appearance. The height is 8′ in front and 5′ in the rear, thereby giving a gentle slope to the roof, a fair amount of head room in which to work in the rear of the house, and only a small air pocket in the front near the roof. Most houses are either too low, giving insufficient head room in which to work, or they are too high, causing a large air pocket to be formed in the front near the roof. This means

just that much more air space which must be heated up by the birds' bodies on cold winter nights.

The perches and droppings boards are in the rear out of the way, and, for most localities are far enough from the openings in the front (twenty feet) to prevent frozen combs, or if not to prevent them, at least to bring these cases down to a minimum. Nests are arranged under the dropping boards, thereby making use of a waste space, and trap nests may be placed along the side walls if desired. A large, built-in mash hopper is placed between sections where only two sections or units are built and between alternate units where more than two units are built. In addition, there is room for smaller hoppers, should they be desired, as shown in the plan.



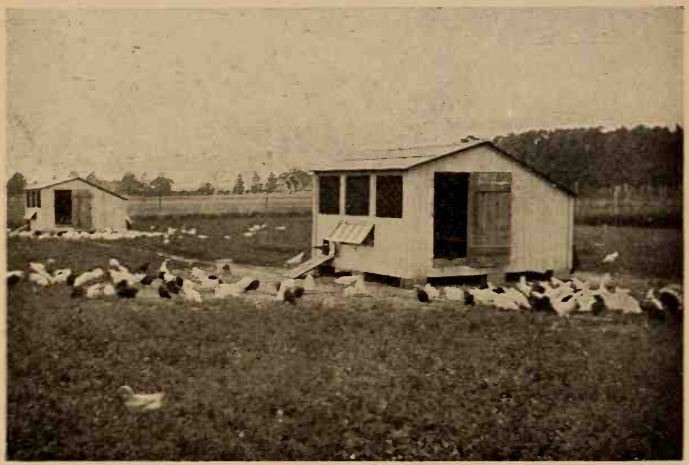
Courtesy N. J. Agricultural Experiment Station.

Fig. 4. Cross section of double unit house.

Fresh air and sunlight are obtained through the two large openings, for which there are muslin curtains, each 4′ x 5′ and two glass windows each 2½′ x 5½′ in each section. Further ventilation is provided for in the late spring, summer, and early fall by having the top board on the back, running the whole length of the house, hinged. This is kept shut in the winter, but is allowed to remain open during the late spring, summer, and early fall months. This provides for a circulation of air through the house at all times, as the front openings are left open continually, except for severe rainy weather or windy weather and, of course, real cold weather in winter. Drafts are guarded against by having double boarding from the droppings boards up along the rear of the house and following the roof, just over the perches and to the front of the droppings boards. This allows an air space about four inches in back of and over the perches, through which the air from the rear may enter and circulate to the front of the house without blowing on the birds while they are roosting. Drafts are further guarded against by having a solid partition every twenty feet, i. e., where more than one unit is built in a house, from the rear of the house to the built-in mash hopper. This prevents drafts on the perches. I would further suggest, that the solid partition be built between each section where there are more than one section in a house, for with only two sections even,

Courtesy N J. Agricultural Experiment Station

A handy feed cart that is useful in feeding small or large pens, especially a number of small pens (see chapter V)



Courtesy N. J. Agricultural Experiment Station

Plate XIII. A 10′x12′ house of the two-thirds span type, which may be used as a laying house or as a colony brooder house. A handy house for any purpose

there are bound to be some drafts—especially on the floor. By having this partition extend from floor to roof and from front to rear, these drafts are broken up. Of course, there should be a door between sections, but this should be a solid and not a wire door.

In many cases a cement floor is used. This type of floor is especially efficient where the ground is dry as a general thing, but where there is a tendency for the ground to be wet, a wood floor is better. Where cement floors are used, there should be at least a foot of cinders well tamped just beneath the cement. This is for the purpose of drainage. Cement floors have the added advantage of being proof against rats. Where board floors are used, the houses should be elevated from 10″ to 12″ to prevent rats from harboring there and making it harder for them to gain an entrance.

Following is the lumber list and list of materials needed for the 20′ x 40′ house described above:

Sills:	6 pieces 4″ x 6″ x 20′	hemlock or yellow pine.
Or:	12 pieces 2″ x 6″ x 20′	hemlock or yellow pine.
Plates:	8 pieces 2″ x 4″ x 20′	hemlock or yellow pine.
Posts:	3 pieces 4″ x 4″ x 14′	hemlock or yellow pine.
	1 piece 4″ x 4″ x 10′	hemlock or yellow pine.
	1 piece 4″ x 4″ x 16′	hemlock or yellow pine.
Studding and overhang:	16 pieces 2″ x 4″ x 16′	hemlock or yellow pine.
	5 pieces 2″ x 4″ x 14′	hemlock or yellow pine.
	7 pieces 2″ x 4″ x 20′	hemlock or yellow pine.
Rafters:	21 pieces 2″ x 4″ x 22′	hemlock or yellow pine.

Purlin: 2 pieces 2″ x 6″ x 20′ hemlock or yellow pine.
5 pieces 2″ x 3″ x 16′ hemlock or yellow pine, frame for nests and droppings boards.
600 sq. ft. 8-inch novelty siding for end walls and front.
2000 sq. ft. 8-inch tongued-and-grooved yellow pine boards for roof, droppings boards, rear wall, and nests.
200 linear feet 1″ x 2″ white pine or cyprus for curtain frames and trim.
100 linear feet white pine or cyprus for nests.
1060 sq. ft. or 11 rolls of roofing paper.
9 sq. yds. muslin.
Nails: 10 lbs. 20-penny wire; 50 lbs. 10-penny wire; 20 lbs. 8-penny wire.
Hardware, such as hinges, locks, tacks, hooks, and wire.
If cement floor is desired, figure in
35 bags of cement.
30 cu. yds. cinders or gravel.
5 cu. yds. sand.
If board floor is desired, figure in
800 sq. ft. 6-inch tongued-and-grooved yellow pine.
22 pieces 2″ x 4″ x 20′ hemlock or yellow pine.

I will not attempt to give an accurate price on the above material, as prices are coming down all the time and they vary so from one locality to another. Suffice it to say, therefore, that the above house, including materials and labor ought to cost from $2.00 to $2.25 per bird to build. In some localities, this price may be high, while in others it may be a trifle low. I think it can safely be counted on as an average price, however. Other materials than those mentioned above may be used; for instance, Virginia pine may be used in place of yellow pine or hemlock in some sections.

Other Types and Sizes

The above described type is known as the shed roof type and is also known as the large house type. Other roof types are given here, as the

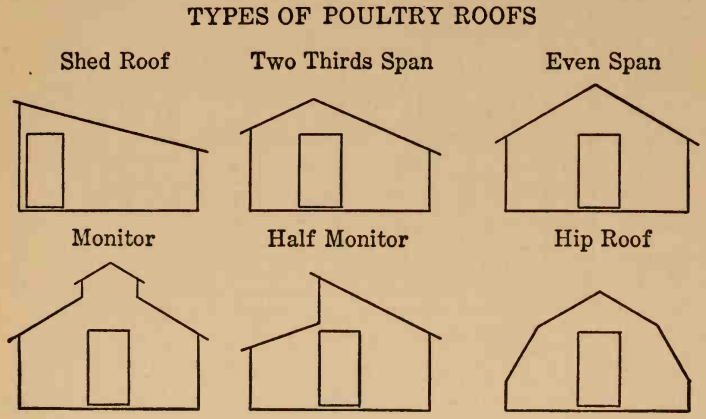
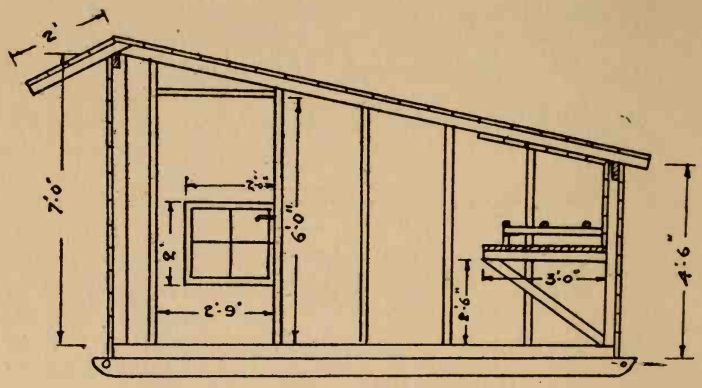


Fig. 5. Various kinds of roofs used in the construction of poultry houses; the shed roof type and the two-thirds span are most popular.

gable roof, uneven or broken span, monitor, half monitor, and hip roof. They all have their advantages and disadvantages, but for ordinary use, the shed roof type and the broken span types are the most popular and satisfactory. Only these two kinds will be considered, therefore.

Where the colony system of keeping chickens is followed, small houses are used instead of the large house described above. These small houses may be modeled after the 20′ x 40′ house already

discussed. The same layout exactly may be followed, except, of course, on a smaller scale. Pictures of two of these houses are shown, also the



SECTION SIDE ELEVATION

Courtesy of N. J. Agricultural Experiment Station.

Fig. 6. Cross section of a 10′x12′ house very similar to the double unit house.

lumber list for one of them. They make very satisfactory houses for the commercial man who raises poultry according to the colony system, or for the farm flock, or for the small back lotter. It might be mentioned right here that these small houses can be purchased in sections, that is, floor, roof, sides, back, and front, and need only be put together upon arrival. This is a very handy way of buying and seems to work out very satisfactorily. Prices will be mentioned later. I shall also mention in another chapter the advisability of keeping birds in small or large houses.

The lumber list given below is for a 10′ x 12′ house with a shed roof. This house as well as the 10′ x 12′ with a broken span here shown, is a very

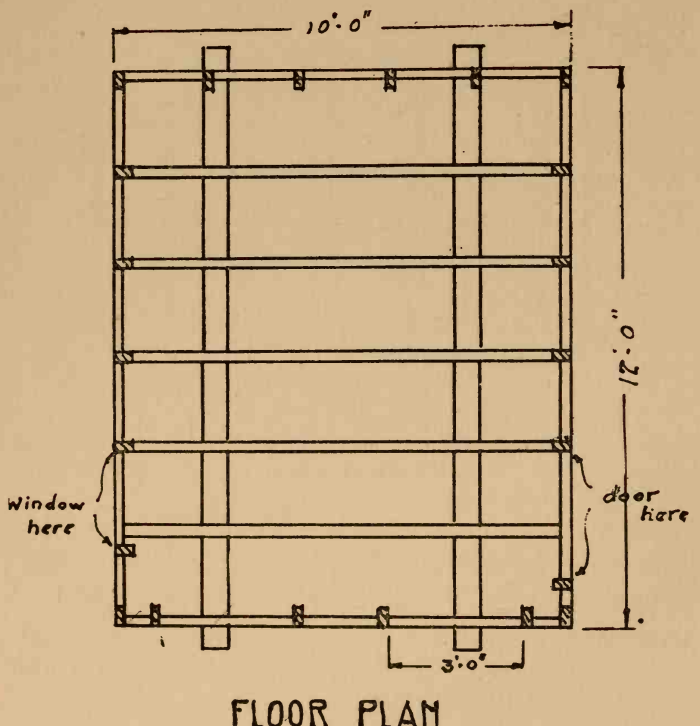


Fig. 7. Floor plan of the popular 10′x12′ house mentioned above. The exterior is different from that shown in Plate XIV, but the interior is the same in both cases.

popular one. They adapt themselves very well to use as colony laying houses for the commercial

poultry keeper, the general farmer who has a farm flock, or to the suburban dweller. They may also be used, where desired, as colony brooder houses, thereby serving more than one purpose. Lumber list follows.

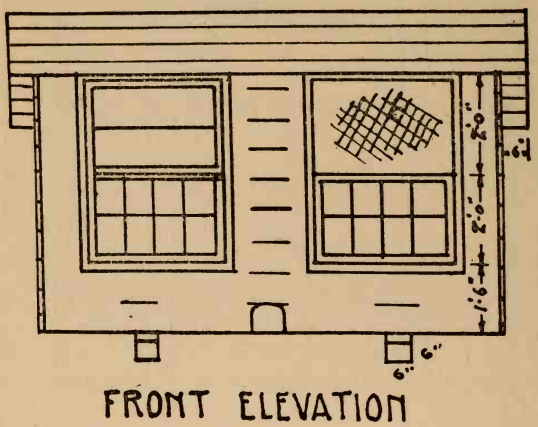
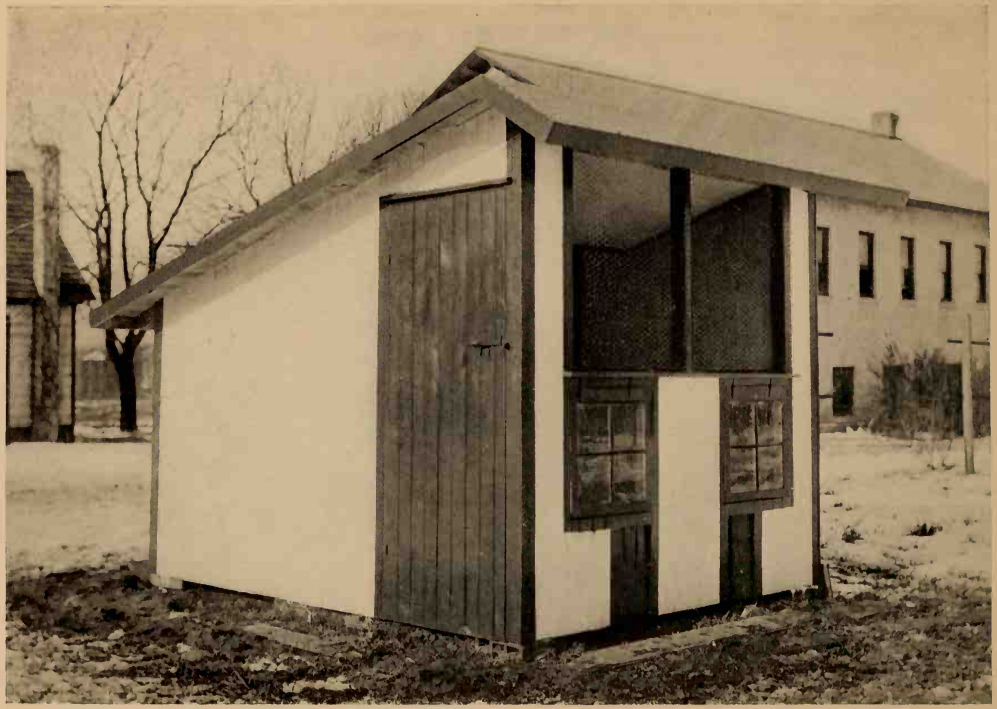


Fig. 8. Front elevation of popular 10′x12′ house.

Skids:	2 pieces 6″ x 6″ x 14′	hemlock or yellow pine.
Plates:	14 pieces 2″ x 4″ x 10′	hemlock or yellow pine.
Studs:	14 pieces 2″ x 4″ x 12′	hemlock or yellow pine.
Rafters:	6 pieces 2″ x 4″ x 14′	hemlock or yellow pine.
Roosts:	3 pieces 2″ x 2″ x 10′	hemlock or yellow pine.

260 sq. ft. 8″ novelty siding.
380 sq. ft. 8″ tongued-and-grooved yellow pine.
20 sq. ft. 8″ tongued-and-grooved white pine.
170 sq. ft. rubberoid.
2-2′ x 3′ sash.
1-2′ x 2′ sash.

Besides this, of course, there are nails, hinges, muslin, locks, etc. The whole lumber list totals



Courtesy N. J. Agricultural Experiment Station

Plate XIV. An 8′x10′ house of the shed roof type. This size house or one of the same type but a little larger (10′x12′) is ideally suited for the backyard flock

up to $70. As I said in the case of the prices for the larger house, this price may vary with locality and other conditions. This same house is made by a lumber firm of which I have knowledge for $75.00; this is all put together in sections, and is really a cheaper way of buying it.

Smaller houses, such as the 8′ x 10′ which is shown here, may also be used, but it is my opinion that a trifle larger house, as the 10′ x 12′, will work out to better advantage and will prove more satisfactory in the long run.

CHAPTER V

THE BEST SIZED FLOCK

ALBERTSON, who has had several years' experience in raising chickens, has been keeping his birds in large flocks of from one hundred to two hundred birds in a flock. Davis, on the other hand, who has had just as much experience as has Albertson, has been keeping his birds in flocks of from twenty-five to thirty birds each. The question is: Has Davis an advantage over Albertson? We believe that Davis has several advantages over Albertson; in other words, that the small flock has several advantages over the large flock.

In the first place, as to production. A small flock will generally yield more eggs proportionately than will a large flock. Let us take, for example, the production of the first year of the First Vineland International Egg Laying and Breeding Contest. There were a thousand birds in this contest, kept in one hundred flocks of ten birds each. The average production of the birds in this contest for their pullet year was 161 eggs apiece.

The average production a bird for the year of

the International Egg Laying Contest at Storrs, Connecticut, was slightly better than this for the same year quoted for the Vineland Contest. The production of the third year of the Vineland Contest was 178 eggs apiece, a gain of 17 eggs a bird over the first year. The birds in the Connecticut contest are also kept in one hundred pens of ten birds each. Now, from a survey of 150 poultry farms in the state of New Jersey, the average production a bird for the year was only 108 eggs on an average-sized farm with a little over 700 birds.

To be sure, the 161-egg production and the 178-egg production were made at a contest, but it must be remembered that there were one hundred different families of birds represented here, while on the farm there is but one strain which can be bred for laying ability, and the birds can receive every bit as good care as can the birds at a contest. In order to bring the figures nearer for comparison, let us assume that the average production of a bird for a small flock is 144 eggs and 120 eggs for a large flock—a difference of two dozen eggs a bird. At an average price of sixty-one cents a dozen—the average for last year—the difference is $1.22 per bird. But that this might not seem too large, let us take the average price several years ago when eggs were cheaper than they have been lately—let us take the average in

1919 which was forty-six cents. This makes a difference of ninety-two cents a bird at that.

The Difference in Housing Costs

It is generally considered that large flocks can be housed more cheaply than can small flocks. If this is true, then we must consider this fact in figuring the difference in returns from large and small flocks. In other words, the cost of buildings and equipment for housing a thousand birds in flocks of, say, thirty birds is much greater than for housing birds in flocks of two hundred to five hundred. This necessitates figuring interest on a larger investment and depreciation on a greater equipment; thereby requiring a greater income to produce a profit equivalent to that produced on a large-flock farm and an even greater income to produce a greater profit than that produced on a large-flock farm.

Another factor that must be considered in comparing the small flock with the large flock is the labor involved in caring for the birds. The labor is greater for a small flock system than for a large flock system. However, by a proper arrangement of the houses and establishment of a definite system of caring for the birds the labor can be cut down to a minimum. Nevertheless, granting an increased initial cost and an increased labor item, which we believe is not so great as has generally

been supposed, we feel that in the long run the small flock will come out ahead. Undoubtedly not the first year, probably not the second year, possibly not the third year, but after that time, whatever profit is made will surpass that made by the large flock, because the initial debt will have been cut down, thereby reducing the interest.

Increased Egg Production

Since production is the main factor in profitable poultry raising and the larger the production the larger the profit, the small flock has this distinct advantage over the large flock, that a small flock yields a higher percentage of production than does a large flock.

The main advantage of the small flock over the large flock is in increased egg production. Why is it that birds when kept in flocks of from twenty to fifty will produce more than when kept in flocks of one hundred or more? Perhaps the best answer to this question will be found in the fact that birds can more easily be watched when kept in small numbers than when kept in large numbers: sick birds can be spotted more easily and removed from the flock; an epidemic may be prevented by keeping the disease confined to one house; the ordinary sanitary precautions can be practiced more easily. In short, more complete sanitary control can be exercised over a small flock, due to the fact that the operator is in a

better position to watch the health of each individual bird than he is with a large flock of birds, since he has every bird directly before his eyes as soon as he opens the door of the henhouse. This is not so when birds are kept in larger units than one hundred birds, for all the birds cannot be seen as soon as the door is opened, especially in the case of houses where there are partitions dividing the units and the birds run from one unit to another. An eye cold, roup, or canker may very easily be missed in such a large number of birds until the disease has a firm hold on the flock.

Not only the sanitary condition of the birds, but also the development of the pullets in the late summer or early fall can be watched more easily in the case of the small flocks. Poultry keepers know that some pullets develop more rapidly than others, due to variations in the individual make-up of the birds, some developing in size and weight faster than others and some even starting to lay quite a while before the other birds—this from birds hatched at the same time. Now is it right to keep the birds that have developed rapidly under the same conditions, receiving the same ration as birds that have not yet begun to lay or even have not attained the same body growth? This is exactly what is done in many cases where large flocks are kept. Some pullets that have not developed so rapidly as others are put in the same house with the more rapid growers.

When birds are kept in small flocks, these slow-maturing pullets can be separated from the others and kept by themselves. They can be brought into condition quicker than if they had been placed with the other more mature pullets and fed as mature birds just beginning to lay are fed. On the other hand, the rapidly developing birds can be benefited in the same way: if only a few pullets from the growing stock develop quickly, they need not be held back by the rest of the youngsters, but can be put into a house by themselves and rounded into condition quicker and better than if they had been held back for the slower-maturing pullets. A small-flock system admits of just such selection and development.

In a flock of layers there are always some that get every bit of feed to which they are entitled, there are some that get all they're entitled to and a little bit more, and there are others that don't get all they need. In other words, in nearly every flock there are a few birds which don't get all the fed they should get, owing to the fact that other birds are more aggressive and get there first. It may not be possible by external appearances to tell just exactly which pullets are the non-aggressive ones, but the writer believes that every flock has them and that they show up as the low producers. The point is this: Since there is a smaller number of birds, more accurate feeding can be prac-

ticed in small units, thereby giving each bird more of a chance than in a large unit.

Spotting the Non-producers

Keeping birds in small flocks admits of another possibility as a money-saver—namely, ease of culling. The units suggested are so small that every bird, as mentioned before, is under the farmer's eye as soon as he opens the henhouse door. This being so, it is a simple matter to spot a pullet in the summer, as soon as she has stopped laying, and remove her from the flock. This is not always the case when birds are kept in large flocks.

To be sure a good poultryman will keep a watchful eye on his birds at all times, even if they are kept in large flocks, but he will be very likely upon spying one lone cull to say, "Oh, well, I'll leave her there until I go through the flock in a couple of weeks." By that time others have stopped laying and have joined the first one in eating feed and returning nothing. Thus, culls can be picked out of the small flocks as soon as noticed and with very little trouble, resulting in a saving in feed consumed and time required to cull.

The labor problem in caring for small flocks is one disadvantage in comparing large and small units. However, if the poultry plant is properly laid out, small-flock keeping can be considered as a commercial proposition. Indeed, the writer has

in mind an experienced poultryman who has recently laid out a poultry farm of two thousand birds on a small-flock basis in Vineland, New Jersey—one of the largest poultry sections in the country. The owner of this plant has his houses arranged in such a way as to take care of the birds with a minimum amount of labor.

His two thousand birds are housed in forty houses, ten by sixteen feet each, with fifty birds in a house. These houses are arranged along two roads—ten houses on each side of each road, all facing the direction in which the road runs. The roads run north and south, consequently the houses face south. The houses are entered by a side door from the roads. Water is piped the length of the roads with a faucet for every four houses; this facilitates watering the birds and eliminates long hauls of water by hand or frequent trips of the water wagon. Feeding is easily done in one trip by means of a cart or wagon similar to the one illustrated (see Plate XIII). The trip is made from the feed house down one row and up the other, thus doing away with retracing of steps.

It is not his plan to have a yard for each house. He is planning to keep the birds shut in nine months of the year, so he has only four yards, thus allowing the birds to run together in the season of the year when they are not producing heavily—July, August, and September. A great deal is

saved in fencing material. With a system such as this, one man can easily take care of two thousand birds—except, of course, in the season of incubating, brooding, and rearing—unless a greater part of the birds are to be trapnested. In that case, additional help is required.

The writer believes that a larger production a bird can be obtained by keeping birds in small flocks than in large flocks. Why is it that beginners, with no previous experience whatever, so often make a great success of it when starting with a small flock? Care is the secret of the whole thing, and we believe that birds can be given better care with better results in small flocks than in large flocks.

CHAPTER VI

HENS VS. PULLETS

He was a prosperous farmer, was Mr. T——, having made his money in general farming. However, he had not much use for chickens. When I asked him what his objections to raising chickens were, he complained that "the pesky things" didn't lay enough to pay for the trouble in taking care of them, especially when the price of eggs was the highest. After some questioning I found out that a few of his layers were pullets just starting to lay, while the most of them were old hens, ranging from two to four years of age, some of which had long since passed their usefulness. The large number of old birds in the flock he explained by saying that "the folks didn't care particularly about eating the old tough birds, they'd rather have the younger ones; besides, the older ones lay more than the other ones." When I laughed at this statement, he seemed inclined to resent it, but I soon produced the evidence that established my right to laugh.

In order to convince by figures which were absolutely accurate, I showed him a record of some

of the results obtained during the first two years of the First Vineland International Egg Laying and Breeding Contest, which is run by the poultry department of the New Jersey Agricultural Experiment Station. By means of these figures, kept on the same birds during a period of two years, I was able to point out to him the value of keeping a greater number of pullets and a smaller number of old birds.

The number of eggs a bird lays is one of the biggest factors in profitable poultry keeping, whether it be in the commercial poultry flock, the suburban backyard flock, or the farm flock on the general farm. It has been learned that, in order to meet expenses a bird must lay at least ninety eggs a year, and for every egg she lays above that number she returns a profit—the more eggs, the greater the profit. My friend was willing to admit that this was so, but wanted to see how this showed a balance in favor of pullets. "Very well," I said, "look here. The average production a bird during the pullet year was 162 eggs, while for the yearling year it was only 129 eggs —a difference of thirty-three eggs." This, I showed him, included four different breeds: Plymouth Rocks, Wyandottes, Rhode Island Reds, and Leghorns. He was especially anxious about Rhode Island Reds, since all his birds were of that kind. Here is the table I showed him, giving

the production a bird for the pullet year and yearling year for each breed:

Breed	Production Pullet Year	Production Yearling Year
Plymouth Rocks	155	119
Wyandottes	144	115
Rhode Island Reds	151	117
Leghorns	170	138

This advantage of pullets over yearlings, or hens, shows itself not only in number of eggs laid, but also in profits. Since the pullet lays more eggs in a year than does the hen, she has to start earlier and hold up later in the season than a yearling does. The result of this is that a pullet lays more eggs in the fall of the year, when eggs sell at high prices, than does a hen, while a hen lays her eggs in the spring and early summer, when eggs are most plentiful and the price, therefore, the lowest. A glance at the following table, showing profit per bird above cost of feed for four breeds—as in the preceding table—shows how the increased production of pullets over yearlings affects the farmer's pocketbook:

Breed	Profit Pullet Year	Profit Yearling Year
Plymouth Rocks	$2.91	$1.39
Wyandottes	2.92	1.51
Rhode Island Reds	2.97	1.50
Leghorns	4.30	3.11

As Mr. T—— was interested in Rhode Island Reds, I pointed out to him how a production of 151

eggs a bird in the pullet year produced a profit above feed cost of $2.97 a bird, while in the yearling year the production decreased to 117 eggs and produced a profit above feed cost of only $1.50 a bird. In other words, a difference of thirty-four eggs meant a difference of $1.47—just half what it was in the pullet year. Mr. T—— opened his eyes in wonder.

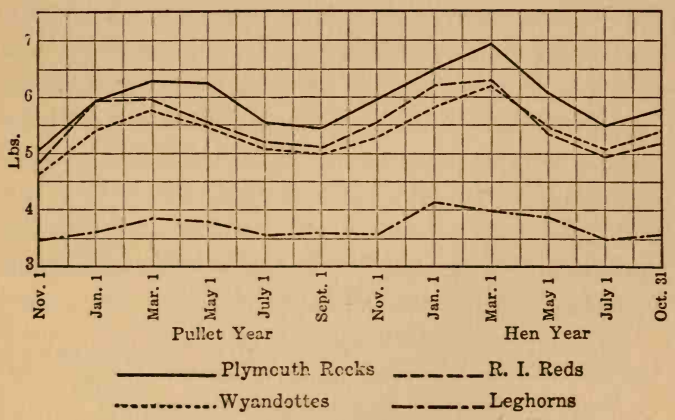
A twinkle then came into his eyes, and he remarked, "Well, they had to give them a lot more feed to get those extra eggs." I told him in the first place that it didn't make any difference as long as they actually produced a bigger profit—the results were there. They had produced more and earned more. In the second place I showed him he was wrong in his statement. The pullets had not eaten a bit more than the hens and had produced more eggs. By actual figures, the Rhode Island Reds had consumed 80.5 pounds of feed a bird during their pullet year and exactly the same during their yearling year.

Feeding for Maximum Production

How was this? Where did the feed go if it didn't go into the production of eggs? A glance at the accompanying chart shows the answer. The birds in their first or pullet year were not so heavy as in their second or yearling year. They therefore did not have such a large amount of flesh to support and could put their feed into eggs.

That's exactly what happened. In the case of the Rhode Island Reds, for example, the highest weight attained a bird in the pullet year was almost six pounds, while in the yearling year the highest weight attained was a trifle over six and one-quarter pounds. The same thing is true of all breeds; they are heavier their second year and cannot lay so many eggs as during their first year, because of the fact that they have to nourish their bodies in addition to laying eggs. Consequently, not so many eggs are laid. Of course, there are exceptions in individual birds, but these are few.

Incidentally, another lesson may be drawn from a glance at this chart—that is, the condition of



Courtesy of N. J. Agricultural Experiment Station.

Fig. 9. Chart showing average weight per bird at bi-monthly periods during pullet and yearling years. Similar figures may be expected in any flock.

flesh in which birds should be to obtain the maximum efficiency in production. The chart shows that birds, hens and pullets alike, reach their greatest weight between January and March. Up to this time they have not been producing heavily, but from this time on they will produce heavily, since it is the natural season of production. The important fact here is to feed the birds so that this weight is taken on before the heavy producing season. This is accomplished by feeding more grain than mash. It is necessary for the birds to have attained their maximum weight before the heavy laying season, as the laying of a large number of eggs is a strain on the birds' systems. A noticeable loss in weight after March first may be observed from the chart, due to the fact that the bird draws on this supply of fat for the production of eggs. Care must be exercised in feeding, however, so the birds will not become too fat. In general, it is a good plan to get them up to standard weight and not allow them to become heavier. Standard weights for the Plymouth Rocks, Wyandottes, Rhode Island Reds, and Leghorns are as follows:

Breed	Pullet Weight Pounds	Hen Weight Pounds
Plymouth Rocks	6	7½
Wyandottes	5½	6½
Rhode Island Reds	5	6½
Leghorns	3½	4

Bringing the pullets into proper condition in the fall or late summer is probably half the battle in getting good production during the year. During the growing period, they have been getting a growing mash along with their grain ration. Now, when the birds' combs become large and brighten up and the first pullet eggs appear, this feeding schedule should be changed slightly: the mash should be taken from them and they should receive a grain ration only. This system should be followed for about two or three weeks, after which time the birds should be allowed to have their laying mash and the grain ration should be cut down somewhat. The purpose of this change in feeding schedule is to check the pullets until they have had a chance to put on more weight, and thereby enable them to go up through the laying season in better condition. From this time on, until about the middle of November, the pullets should continue to receive a larger proportion of grain to mash, gradually decreasing the amount of grain after this date until they are getting equal parts of mash and grain. Of course, the rapidity with which the grain is cut depends entirely upon the condition of the birds themselves—it may be that the larger proportion of grain may be desirable for a longer period. Equal parts of mash and grain ought to be kept up until just before the birds begin to fall off in production, which is late spring, and from this time on more mash should

be consumed than grain to help maintain as high a production as possible. Hens, as a rule, should have slightly more grain than mash during the early fall, slightly more mash than grain all during the heavy-laying season, and increased amounts of mash during the late spring and summer.

Increased Mortality of Hens

One other point worth while considering, which, though a minor one, Mr. T—— had to admit was true, is the increased mortality of hens over pullets. For example, during the pullet year at the contest the mortality was ten per cent., 102 birds out of 1000 having died, while during the yearling year it was 14.7 per cent.

On most commercial poultry farms it is the general practice to keep from fifty to seventy per cent. of the total number of birds pullets, the old birds being kept for breeding purposes. Since it is inadvisable to breed from pullets, on account of lowering the vitality of the resulting stock, yearlings and sometimes three-year-olds are kept for this purpose. As soon as the pullets stop laying—it may be any time from July to October—they are sold for meat, only the best and highest producers being saved for breeders the following spring. In this way, in addition to the added profit in eggs produced by the pullets, a certain amount of cash is returned to the owner which

goes a long way towards paying for the raising of the new pullets that are to replace the old ones.

There is still one other place where pullets get the jump on the hens and that can be pointed out better by figures than by words. The contest figures show that there were 372 cases of broodiness in the pullet year with a loss of 8,783 days. During the yearling year there were 321 cases of broodiness with a loss of 10,076 days—fewer cases but broody for a longer period. The actual money loss thus sustained during the pullet year was $162.96, or about 44 cents for each broody bird, while for the hen year the loss was $215.69, or a loss of 67 cents for each broody bird. Isn't this convincing?

The possibility of keeping only pullets presents itself to those not interested in breeding, as it is possible to replenish one's stock from year to year by purchasing "squab pullets"—pullets at eight or ten weeks of age—for about a dollar and a quarter a bird. These may be purchased in June, July, or August and save the purchasers all the trouble of brooding, since most of the danger in brooding is over by that time. The expense of keeping these pullets until they commence laying in the fall is small and the initial cost of the "squabs" may be met the following summer and fall when the birds are sold for market. This method should be employed each year by backlotters—indeed, in this case it would undoubtedly

be better to buy the mature pullets, as there is very seldom the proper range for the growing of young stock. The idea of replacing the flock each year is the main idea in this last case.

General farmers will do well to allow themselves to be convinced, as Mr. T—— did, of the value of keeping a large percentage of pullets in their laying flocks and a smaller percentage of old hens. Production will increase and the once-made-fun-of hen yard will come into its own.

CHAPTER VII

A BALANCED FLOCK

Why is it that a great many poultry flocks return the bulk of their income at one season of the year? How much better it would be if this income were distributed uniformly throughout the year rather than all in a lump! The poultry keeper has means at his command, if he but knew it, to aid a great deal in balancing his returns. Start at the beginning and balance the flock.

The first step is dividing up the labor among the birds, so that when one gang is working the other gang is resting, and vice versa. This is accomplished by having approximately a third of the flock composed of some heavy breed, such as the Plymouth Rocks, Wyandottes, or Rhode Island Reds, and the remainder of the flock Leghorns. It is true that Leghorns will ordinarily average a good many more eggs per bird during the year than will the heavy breeds and will return a larger profit. But there is a season of the year when the heavies have their innings, and that season is from the early part of September to the latter part of January.

Let us take a concrete example. Suppose a

man has 1300 birds—1000 Leghorns and 300 Plymouth Rocks. On the first of December the Leghorns are laying ten per cent., or 100 eggs per day. The Rocks are laying twenty per cent., or sixty eggs a day. This makes a total of 160 eggs from both flocks. Now suppose they were all Leghorns. The 1300 Leghorns would be making a ten per cent. production, or 130 eggs a day—thirty eggs more a day with part Rocks and part Leghorns than all Leghorns. At this season last year eggs were selling at one dollar a dozen. This means $2.50 a day more in the poultryman's pocket. Of course the price may not be a dollar a dozen for any length of time; but even so, this is the season of high prices for eggs, and such a division of responsibility among the birds will net easily a dollar and a half a day.

Pullets for Eggs, Hens for Breeding

Between February and September the Leghorns will come to the fore and show the Rocks, Reds, Wyandottes, or whatever they are, their heels. In late summer, the heavy breeds will again start to head off the light breeds. How such a combination will help to keep the production uniform can easily be seen. In addition to this seasonal production of eggs, the heavy breeds can be relied upon for meat production. Heavy broilers, roasters, fowls, and capons are much in demand and bring excellent prices.

The second step in our process of balancing the flock consists in dividing our flock—heavy breeds and lights—according to age. Pullets should be relied upon for the bulk of the egg production and yearlings or older hens for breeding and replenishing the stock. The reasons why pullets are depended on to increase receipts are: (1) A bird will lay more eggs during her pullet or first year than during any other year, as a rule. (2) The cost of feeding a pullet is less than the cost of feeding a hen. (3) Pullets are less broody than hens. (4) The normal mortality is lower in a flock of pullets than in a flock of hens.

The first year of a bird's life is generally her heaviest producing year. There are exceptions to this, of course, but nine out of every ten birds will lay more in their pullet year than in any other. This applies, in general, to all breeds. A pullet eats less and therefore costs less to keep. This stands to reason, because as a bird grows older she gains in weight, and, naturally, the more flesh she has the more feed she has to eat to maintain herself. While she is maintaining herself she is losing time in the producing game; also the more flesh, the more heat. Perhaps this accounts for the greater broodiness in hens than in pullets. At any rate, more time is lost—and therefore money—in the hen year than in the pullet year. So with mortality, which is nearly always greater in older than in younger animals.

Lastly—and here's where the hens shine—when used as breeders they produce larger, stronger, and healthier stock than do pullets. Approximately two thirds of the flock should be pullets and one third hens.

During the Hatching Season

The last step in our balancing process is the determination of our hatching season. Why? Because the time at which a chick is hatched affects very largely the time at which this chick as a pullet is going to start laying, and to some extent, the duration of her laying period. Hatching a certain proportion of the flock earlier than the normal hatching season will bring these pullets into laying condition earlier than if they are hatched in the normal season. The advantage of doing this can readily be seen. The older birds will drop off in their production in the late summer and early fall; the new stock, if hatched in the normal season, will not begin laying until late fall.

There is, then, a period when production is very low. The problem is to fill up this gap—a thing which is easily done by hatching some of your Leghorns in February. These pullets so hatched will begin laying in early August and will lay for a couple of months before going into a molt, after which they will be good as breeders in the follow-

ing spring. This is not recommended for the heavy breeds.

When this is practiced, about one third to one fourth of the Leghorn flock should be hatched in February and the remainder about the middle or latter part of April. The heavy breeds ought to be hatched in March. Great care must be exercised with early hatched chicks, since they are being brooded out of their normal season. With good care and an abundant supply of green food in the form of sprouted oats or similar product, the chicks ought to come through all right.

These three factors, then, in the proper balancing of a flock should receive careful attention and be planned in advance:

1. One third of flock heavy breeds, two thirds Leghorns.

2. Two thirds of each flock, both Leghorns and heavy breeds, pullets and one third hens.

3. A third to a quarter of the Leghorn flock hatched in February and the remainder in April. Heavy breed flock hatched in March.

CHAPTER VIII

PROFITABLE EGG PRODUCTION

INDIVIDUAL high-producing birds are few and far between—that is, real high-producing birds, those laying three hundred eggs a year. There are, indeed, few flocks that will average better than two hundred eggs per bird—if they average even that many. Yet it is this factor more than any other, the number of eggs laid, that determines a profit from a flock of birds. From a survey of one hundred and fifty poultry farms in New Jersey, made just before the war, it was found that when a hen had laid ninety eggs she had paid all her expenses for the year, and every egg she laid over that number was clear velvet. The more eggs, the greater the profit. The importance of having a flock of high producing birds can readily be seen.

Increased egg production depends primarily upon three factors: Proper selection and breeding of the stock, proper growing and maturing of the pullets, and a healthful environment in the laying house, together with proper feeding methods. Stock is the most important of the factors

mentioned, for poultry keepers everywhere will agree that unless a bird has the "stuff," or breeding, back of it, it will not be much of a producer.

There are three ways by which a poultry keeper may go about building his flock to increase the egg-producing ability of his birds, no matter whether he has a large commercial flock, a medium-sized farm flock, or a small backyard flock. The first is by selecting the high producers through trapnesting—the most accurate method but the most laborious, and incidentally the best; the second is by selecting them by means of external characteristics—certain visible characters which indicate the ability to produce; and the last is by combining the first two, trapnesting some and selecting some by their external characters.

The Trapnesting Method

No matter which of these methods is followed, all fowls selected as breeders must be healthy, vigorous birds, free from any objectionable characteristics; in other words, nothing must be sacrificed for egg production. A bird must not be selected just because her mother was a good producer, regardless of the fact that she herself is small and weak-looking or far off from the color requirements of her breed and variety.

If the trapnesting method is followed, birds should be trapped during their pullet year, or first year of producing, selecting to be used

as breeders the following year those that showed not only high production—anything over 150 eggs—but also a tendency to lay early in the fall, say the early part of October, and lay uniformly throughout the winter. Of course, the later in the summer a bird stops laying the better, because she is likely to be a heavy producer. But even though a bird makes a good production, if her eggs are scattered and she doesn't lay uniformly she is not so valuable as the hen that may not lay quite so many eggs but lays them according to a uniform cycle. An early start, a late finish, and a uniform production in between are what is wanted.

Culling by the Pigment Test

When the second method is followed a great saving in labor is made; and though there is a slightly greater percentage of error in selection, when judging by external characters and without accurate production figures, the results are very satisfactory. During the past four or five years, great strides have been made in culling fowls by the pigment test and other external characteristics. As a result, we know that when a bird starts to lay, the skin just around the edge of the vent changes from yellow to white; after she has laid for about two weeks, the eye ring begins to turn white; about three weeks later the ear lobes—in breeds having white ear lobes—become

bleached out, losing their creaminess. Another three or four weeks sees the beak white instead of yellow; and after a bird has laid about three months, the shanks become white. This, of course, refers to the yellow-skinned breeds—the Leghorns, Plymouth Rocks, Rhode Island Reds, and Wyandottes.

When a bird stops laying, the yellow comes back in exactly the same order in which it leaves. When a bird is laying, her comb is bright red in color and is soft and oily. When she is not laying, the comb is hard, dry, and shriveled up. Also, when a bird is laying, her skin is loose and pliable and the vent is moist.

With these things in mind the farmer should go among his flock four or five times a year, catch up the birds and examine each one. At every inspection he should mark all the birds that are laying by means of a colored celluloid leg band, using a band of different color on each occasion. The times of the year at which the inspections should be made and the manner in which the birds may be marked are: November, a yellow band; February, white; April, green; July, red; and September, blue.

By the end of the year, some birds will have five bands on their legs, some three, some one, and so on. Of course, those that wear all the bands are the highest producers. Birds having the yellow, white, blue combination are also good

birds, because they show that they started laying in the fall, continued laying in the winter, and came back in the late summer and fall again—laying when eggs were the highest. By this method the best birds for breeding may be selected.

The Combination Method

The combination method consists in going through the larger part of the flock in the method just described, culling out birds by the external characteristics, and at the same time trapnesting a small pen of them. The trapnested pen in this case is relied upon to produce cockerels having pedigreed ancestry, to be mated with females selected by the other method. This method is followed because it has been found that high-producing ability is transmitted from the grandmother to the granddaughters through the father.

Raising the Pullets

An important link in the poultry-keeping chain that is frequently overlooked when the subject of egg production is discussed is the manner in which the pullets—the bulk of the laying stock—are grown. Nevertheless, this phase of poultry keeping is of vital importance, for unless pullets are raised under proper conditions they fail to develop properly, and thus start the year as layers

Plate XV. Lack of feed hopper space is a great handicap to maximum production

greatly handicapped. Aside from the fact that growing stock should have a definite grain ration fed to them twice daily, and a definite dry-mash mixture which is kept before them constantly, together with a bountiful supply of clean, fresh water, they must have an unlimited supply of green food.

Free range of an alfalfa or a clover field pushes the youngsters right along and helps to bring them into laying in the fall in the pink of condition. Milk also has its value, and if obtainable, it will aid greatly in developing the pullets. Milk substitutes may be used to advantage if the milk itself cannot be secured. Following is a table showing the rate of growth of young stock—pullets—fed on milk and allowed free range of an alfalfa field:

Age	Weight per Bird (lbs.) American Breeds	Weight per Bird (lbs.) Leghorns
Fourteenth week	2.3	1.9
Sixteenth week	2.85	2.23
Eighteenth week	3.4	2.6
Twentieth week	3.77	3.04
Twenty-second week	4.02	3.23
Twenty-fourth week	4.1	3.35

I said above that the mash should always be kept before the growing stock. This is the proper procedure up to the time the first pullet eggs appear. Just before this the combs have been reddening up and increasing in size, giving every indication that laying is about to begin. This is

the time, when the pullets eggs appear, to take the mash away from the birds, giving them all the grain they will eat. The idea is to check them for two or three weeks, so that they may have a chance to take on a little more flesh and develop just a little more before starting the long, severe laying season. Birds need all the flesh they can take on at this time, to serve as a reserve upon which to draw in the course of the heavy producing period. At the end of about two weeks, the mash may be given to the pullets again, beginning gradually so that they will become used to it before placing it before them all the time. This is the time when the regular laying mash may be substituted for the growing mash.

Money-Making Winter Layers

The date at which chicks are hatched determines very largely just when this finishing process should begin. It also determines very largely just how many eggs a hen is going to lay, for if hatched at a certain time the bird is likely to begin laying, then go into a molt and cease production for a while. On the other hand, if hatched too late in the season, the bird will take so long to reach maturity that it won't be a profitable producer. For money-making winter layers, Leghorns should be hatched any time from the middle of April to the end of the first

Plate XVI. Feed consumed by one hen in a year. Don't begrudge the feed . . . it means eggs

week in May; the heavy breeds, for example the Plymouth Rocks, Rhode Island Reds, and Wyandottes, should be hatched a month earlier.

Method of Feeding

Environment and method of feeding—for they really go together—I gave as the third important factor in profitable egg production. Although the other two factors have been discussed first, the third must not be considered of trifling importance. It is obvious that, given good breeding and rearing and poor environment, a bird will not do its best for its owner—it can't if it is living under poor conditions.

A well-built, light, airy house—as well as clean litter, clean droppings boards, feeding utensils, and water fountains—is essential to the health and happiness of the birds and needs no further discussion. There is one point in this connection which needs mention and which is often overlooked in laying pens—that is, lack of feed-hopper space. Hoppers are nearly always provided, to be sure, but only a limited number of hens can eat at one time. A splendid way of overcoming this difficulty is to build a small hopper about six feet long, eight inches wide, and eight inches deep. Put this on a standard about one and one-half or two feet above the floor in the middle of the house, and you have a hopper that will allow

hens to feed from both sides instead of one, as do the wall hoppers.

During the winter months, especially late winter, the birds should be encouraged to eat as much dry mash as possible, for this is the egg feed. Everything that can be done to increase mash consumption will help to increase egg production. A dry mash that can be recommended is one composed of equal parts of bran, middlings, corn meal, ground oats, and meat scrap. In addition to the dry mash, kept before the layers all the time, a scratch must be fed for maintenance. A good grain ration is one composed of equal parts of cracked corn, whole wheat, and oats. In the winter months the amount of corn may be doubled. In general, if the grain is fed about as suggested in the following schedule, the birds will balance their ration with the proper amounts of mash:

	Lbs. per 100 Birds
November–April	12
May–June	10
July	8
August	6
September–October	5

About a third of the amount should be fed in the morning, the rest round the middle or latter part of the afternoon. Never feed more than the birds will clean up before the next feeding. Failure to observe this rule not only wastes money but

encourages the birds to be lazy and stop working for a living.

How to Sell the Eggs

There are two or three other factors which aid in the profitable production of market eggs. One is the make-up of the flock, which has already been discussed. To be profitable, a flock should be composed of about two-thirds pullets and one-third hens. The reason for this is that pullets produce more eggs than hens, but hens are better for breeders than are pullets. The poultry keeper should, therefore, rely more upon his pullets for producing his eggs profitably than upon hens.

Turning darkness into daylight is the same as turning feed into eggs. That is why it's done: that is why we put lights in the laying house and turn them on in the early morning, giving the birds a fourteen or fourteen and a half hour day. It gives them a chance to eat more feed and consequently to lay more eggs. The lighting may be begun about the middle of November or first of December and continued until April first. It doubles the production during the months when egg prices are the highest and quadruples profits.

Profitable egg production does not end the minute the egg is laid. A fresh egg on a farm is worth nothing—if allowed to stay there. The problem is to get it to market with the least possible cost in time, labor, and money. Eggs may

be shipped in case lots to wholesale commission men, which method requires the least expenditure of time and labor. They may be put up in fancy cartons and shipped in crates to high-class retail stores—a good method since higher prices may thus be obtained than by selling to wholesalers. A local private trade may be developed; this method requires a good deal of labor, though it pays. A parcel post trade may be developed.

There are great possibilities in this last method, since there are not a great many producers marketing by parcel post. It requires quite a little time to pack the cartons, especially where a large trade is developed, but in the end, I believe, it will pay if one has the time and labor available to give this selling method the attention it requires.

The biggest factor of all in profitable egg production I have purposely omitted because it is the hardest to discuss. It's the man himself, the man who manages the flock, feeds the chickens, and sells the eggs. If I were to discuss him, I'd be writing for ages, because there are several millions of him—all different. Needless to say, it all depends upon the person who cares for the birds. What he puts into it he'll get out of it. If he loves his job and keeps his eyes open continually and sees things, he'll have his birds producing eggs profitably.

Plate XVII. A homemade oats sprouter. The bottom tray contains oats sprouted to a sufficient height to feed. This is one means of keeping up production in the winter and keeping the chicks growing during the brooding season

CHAPTER IX

FEEDING DIASTASE FOR EGGS

Six hundred eggs from eight hundred pullets on the twentieth of November! Whew! Can you beat it? To be exact, the production was 596 eggs from 797 pullets, but what's a matter of a few eggs between friends? However, if you or I were to talk to William Johnstone, proprietor of the Johnstone Poultry Farm, of Toms River, New Jersey, we would have to be very particular how we mentioned such things unless we had something with which to back our remarks. He is. A good many poultrymen and a good many general farmers are afraid to be too accurate with their figures, for fear that in the final accounting the balance will not be on the right side of the ledger. Not so with Mr. Johnstone.

A visit to the Johnstone Poultry Farm and an interview with its proprietor are an education in themselves. Indeed, it is because of the methods employed on this farm, as to housing and feeding primarily, that I am taking the pains to set them down for the benefit of general farmer and intensive poultry keeper alike. They are so different

from the methods most commonly used at the present time and the results are so startling and convincing, that one must indeed stop to consider them whether he accepts them or not.

A moist mash is given the birds and is considered to be responsible for the excellent results obtained. It is mixed as follows: For each one hundred layers three pounds dry weight of oats during the months of November to May, and two pounds during the remainder of the year, are soaked for twenty-four hours and germinated for three days at a temperature of about seventy degrees. By this time the roots will average about an inch long and the shoots will just begin to show. Next, four or five pounds of semisolid buttermilk are dissolved in a quart to a quart and a half of warm water.

How the Mash is Mixed

From five to eight pounds of the New Jersey laying mash are then used. This is composed of equal parts of bran, middlings, ground oats, corn meal, and meat scrap. The smaller quantities are used when the pullets go into the laying house and are gradually increased as the birds develop. Enough mash is fed at 11 A. M. so that only a very small quantity remains in the feeders when the hens have gone to roost.

Commenting on the way in which the mash is mixed, Mr. Johnstone said:

"The processed oats are leveled on the bottom of the mixing box or tub and the dry mash leveled on top of this and both lightly mixed and leveled again. The warm, diluted buttermilk is then added and the ingredients thoroughly mixed and rubbed hard against the bottom of the mixer to release diastase from the oats. This is then allowed to stand in a room having a temperature of about seventy degrees for about four or five hours. When mixed, the mash should be neither crumbly nor sloppy, but should hold together in a firm cake when compressed in the hand, this consistency being best for the action of the mash."

He explained further:

"In cold weather the ingredients for the following day's mash are measured and placed in the sprouting room as soon as the mash is mixed, so that they stand for twenty-four hours in a room having a temperature of about 70 degrees. This prevents chilling the mash by using cold ingredients which would retard the action. The diastase of the germinated oats, assisted by the lactic acid of the buttermilk in the presence of the moisture and warmth of the mash, starts a digestive ferment during the time the mash is held in the heated sprouting room, as evidenced by the strong yeasty smell, arising from the mash when ready to feed, due to the carbonic-acid gas given off in the breaking up of the carbon element of the starch in changing it into the more-easily digested sugars."

Good Results at Small Cost

"In addition to assisting the action of the diastase the acid of the buttermilk retards the forma-

tion of the harmful souring ferments that would spoil the mash before it was consumed. A sample of this mixed mash held for forty-eight hours at a temperature of seventy degrees showed no evidence of souring when tasted and smelled. The digestive process thus started in the sprouting room will undoubtedly continue in the crop of the chickens, due to the condition of the mash and continued warmth and moisture."

One would think that all this extra labor would make the cost of the mash high. Mr. Johnstone states, however, that the fuel and extra labor cost of preparing and feeding this mash over the ordinary dry mash is 3.5 cents a hen a year. One extra egg a hen a year pays this cost.

This moist mash is supplemented by a grain ration composed of three parts cracked corn and two parts wheat at the rate of eleven pounds a hundred birds from November to March, gradually reducing to four pounds by October. Five pounds of mangel beets are fed in the morning during the winter and one pound of oats—dry weight—well sprouted, in the afternoon. In the summer the beets are omitted and the sprouted oats are doubled.

The exact winter feeding schedule on the Johnstone Poultry Farm may be summed up as follows:

1. Moist mash mixed at 7 A. M.
2. Beets fed immediately after.

3. Moist mash fed at 11 A. M. in protected metal feeders four feet long, six inches wide and four inches deep, allowing sixteen feet of feeding surface to each 100 hens.

4. Green sprouted oats fed and three-quarters of daily grain ration scattered in litter about one hour before roosting time. Water fountains cleaned and filled.

5. Remaining one-quarter of grain scattered over litter at dusk to act as bait to bring birds off perches when electric lights go on at 3: 30 A. M. by automatic clock.

6. Dry mash, oyster shell, and grit always available.

Asked how he came to feed germinated oats, Mr. Johnstone said:

"About ten years ago while carrying on this work, it was noted through a medical-magazine article that oats were being germinated for the purpose of producing diastase, which because of its digestive action on starch was being extracted and fed as an aid to digestion to patients suffering from digestive troubles at a certain sanitarium. Believing that advantage might be taken of this fact in preparing poultrf feeds, further study along this line revealed the following: Diastase is a peculiar nitrogenous ferment formed by soaking grain in water and keeping it moist until it germinates. It is the digestive juice of the plant which acts on the starch of the seed. Within an hour after soaking the grain diastase begins to form and has the power of dissolving starch into

more easily digested dextrin and sugar, and if this action takes place in the presence of an acid the action is much more complete, as the dextrin is further dissolved into dextrose and other sugars that are ready for assimilation by animal organisms. The action of diastase is so powerful that one part will dissolve or 'predigest' 2,000 parts of starch, and one part of germinating grain will produce enough diastase to convert the starch in six times as much grain into sugar.

"Diastase is also found in the saliva and pancreatic juice of animals. Its function here is to act on the starch consumed in the digestive process. Chiefly because of the great solvent power over starch possessed by the diastase in malt—germinated barley dried and ground—it is extensively used in prepared foods for infants and in the form of malt extracts by persons whose digestion needs assistance.

"Because of the considerable proportion of starch contained in poultry feeds as a whole, it seemed probable that an addition of diastase to the diet would enable the poultry to handle more efficiently the rather full feeding given by most poultry men in an endeavor to make biddy shell out the eggs. The more so since this method would be a perfectly natural addition, as undoubtedly the hen at large under natural conditions consumes a considerable proportion of germinating seeds that it scratches out of the ground, which food is largely omitted from the poultryman's ration. Sprouted oats fed as green food does not supply this deficiency, as the content of the seed is exhausted in producing the green shoot."

Striking Production Figures

There is no doubt that these methods have produced very favorable results. The following figures tell the story. They are the average daily production by weeks from September twenty-fourth to December twenty-fourth, beginning with 800 birds and ending with 782, five having died and thirteen having been culled out:

Week Ending	Average Daily Production	Percentage of Production
October 1	43	5
October 8	80	10
October 15	139	17
October 22	208	26
October 29	312	39
November 5	437	55
November 12	513	64
November 19	551	69
November 26	565	71
December 3	560	70
December 10	514	65
December 17	459	58
December 24	449	57

Since October thirtieth the daily production has never been below 55 per cent.—that is until December twenty-fourth—and the highest was 75 per cent. on November twentieth—596 eggs from 797 birds. On seventeen days throughout this period the whole flock averaged 70 per cent. or higher and on three different occasions during November pens of 100 birds laid eighty-seven eggs. These figures are from pullets that were

hatched from April 17–23, which came as chicks from four different breeders. Mr. Johnstone has kept in touch with these breeders and he feels that the methods used on the Johnstone Poultry Farm have been eminently successful, as the production of his pullets has been considerably more than that of the birds on the original farms from which his stock came.

He feels further, that his system of feeding has been successful not only in getting a heavy production and in keeping his birds in good condition, but also in getting larger eggs than he would ordinarily have gotten by using a different system. As he markets all his eggs through the New Jersey Poultry Producers' Association he is in a position to know exactly how his eggs grade up—he receives such a statement each week. He says,

"When pullets are producing unusually high in fall and winter, the eggs usually become small in size, but though my pullets were giving 66 and 75 per cent. production in late November and early December, the invoice for egg shipment covering the first week in December showed 30 per cent. extra grade, 45 per cent. first grade, and 25 per cent. pullets. Invoice dated December fifteenth on a four-case shipment of the eggs as they run shows 73 per cent. extra grade, 24 per cent. first grade and 3 per cent. pullets, these grades being made while the flock was averaging 60 per cent. production."

Mr. Johnstone believes that the processed moist

mash as he feeds it is more easily digested and the layer is able to obtain more egg-making material with the same effort required under the dry-mash system of feeding. To be sure, he uses electric lights on his layers, but others that were also using lights were not getting the results he was.

Housing Methods

As the feeding methods are unique, so are the housing methods. Each laying house is ninety by eighteen feet, planned to run three in a row end to end with an eighteen-foot space between both ends of the center house and each adjoining house. The roof is continuous, covering the space between houses. At present only one house and three pens of the second house are completed and in use, the remaining pens of the second house and entire third house to be completed this summer. They are divided into five pens, eighteen feet by eighteen feet each, containing one hundred birds to the pen. They are set on a cement-block foundation eighteen inches above ground, level at rear and ends but open in front, with supporting cement piers every six feet. The houses are of the broken-span type, having the height of rear studs eight feet four inches and of front studs five feet four inches, with an interior post eight feet long every six feet down the house supporting a four-inch-by-four-inch roof beam six feet six inches in from

the front wall. These eight-foot posts come directly over a four-inch-by-four-inch beam running the length of the house, these beams supporting the floor joists near the center and resting on cement piers six feet apart. Each pen has two three-foot-by-six-foot hotbed sash cemented down to the front slope of roof and the entire front is open practically from the roof down three feet. A front rain platform extends inward thirty inches from the base of the open front, being waterproof with a slight outward slope. This turns all rain but admits the sunshine.

The grit and shell hoppers and processed-mash feeders are placed on this platform, making convenient feeding. This platform was a new one to me and struck me as being a mighty clever idea, its main advantages being that it aids greatly in keeping the floor and litter dry and that it permits of increased floor space for the chickens.

A thousand chicks brooded in lots of five hundred each were raised to seven weeks of age with a death rate of but four per cent., and smaller lots have been raised with a three per cent. mortality. How is it done? Listen.

The brooder yards are fifty-six feet long by eighteen feet wide. A gate is made that fits right across the yard. By starting it near the house when the chicks are small and moving it a certain distance from the house, the amount of yard room available to the chicks is gradually in-

creased. In each case, a few days before the gate is moved, grain is turned into the ground to be next occupied on the outside of the gate. When the gate is moved down one section, sprouting grain, which as Mr. Johnstone says is rich in diastase, is made available for the youngsters to dig out of the ground. This method is begun when the chicks are about a week or ten days old. Before that time a moist mash is given which contains ground germinated oats.

The loss on range from his flock was only six per cent. He placed 843 good pullets in the laying house and these pullets averaged three pounds and seven ounces each when not quite five months old.

Mr. Johnstone turned to his books, and picking out the month of November showed me that his total expenses for feed, lighting, upkeep, overhead and labor amounted to $350.55. His gross returns for that month amounted to $829.58, leaving a net profit of $479.03. His average cost of producing eggs in November was twenty-one to twenty-eight cents a dozen, with the average price received ranging from fifty-eight to sixty-one cents.

Note:—The methods used on this farm and the results obtained were so interesting, that I am offering them as suggestions in addition to methods recommended in other chapters.

CHAPTER X

THE USE OF LIGHTS ON LAYERS

The two greatest achievements in the poultry industry in the last five or six years are the perfection of a culling system, whereby a poultry keeper is enabled to pick out from his flock the birds that are not laying, merely by their external characteristics, and the use of artificial illumination to increase the egg production during fall and winter when egg prices are the highest. To be sure, lights have been used for the past ten or a dozen years in some sections, notably on the Pacific coast, but it has not been until recently that lights in the laying houses have been used as a commercial proposition in the eastern part of the country.

When lights are used properly, they will double the production in the season of normally low production, namely, fall and winter. Figures have been obtained to show that this doubling of the production quadruples the profits, since the production is so large at the time when the prices are the highest. While in a good many cases, lights serve to increase the yearly individual production, this is not always the case, since the most benefit

comes from the increased fall and winter production. In other words, it does not mean that a naturally poor hen can be made to lay a large number of eggs: the breeding factor must not be lost sight of. There is an additional advantage of using lights on layers and that is that early hatched pullets may be carried through their first fall and winter production with very little if any molting.

The question now arises: What kind of artificial light is the one to use? Will an ordinary barn lantern, for example, give as good results as some other source of light? Experience has shown that while the ordinary barn lantern is a little better than nothing, and the gasoline lantern is satisfactory in some respects, the electric light gives by far the best results in all respects. The oil lantern may be discarded and given no further discussion, for, while it is better than nothing as stated above, the slight increase in egg production due to the use of this kind of illumination is not worth the bother and expense. The gasoline lantern is very satisfactory as far as the amount of light it gives is concerned, but it is a source of danger from fire and involves a great deal of labor in caring for it. It has been discarded by a great many poultrymen for the electric light. The last named source of light is the best of all for cost of operation, efficiency, and labor involved in caring for it.

Installation

Of course, it may not be possible for everyone to have electric lights in his hen houses, especially in a locality where the local electric light company will not extend their lines to accommodate a rural customer or will do so only at great expense. In such a case it might be advisable, if one can afford it, to install a lighting unit. There are several good lighting units on the market and they are really not so expensive when one considers that there is an increased revenue from the chickens in addition to the pleasure and comfort of having one's dwelling house lighted by electricity as well. A flock of about a thousand birds ought to pay for such a plant in one season. I have in mind several men who have made their birds pay for such a unit in one season and have had their dwellings lighted as well. Where electric lights are out of the question, I would recommend gasoline lanterns, which require very close watching. In this discussion on lights, however, I shall base all my remarks upon electric lights, as these are the most commonly used and the most efficient.

It is not the extra light that birds get that causes the increased production—that is only a small part of it—it is the increased amount of feed the birds eat. The part that the light plays is, of course, enabling the birds to see the feed and thereby causing an increased consumption of feed,

which, in turn, causes the increased egg production. This must be taken into consideration, therefore, in installing the lights in a house; that is, the lights must be so arranged as not to put the perches in a shadow—else the birds will not all come down on the floor—and must be so arranged so that the birds will be able to see the grain in the litter and, lastly, must be bright enough for the birds to see the grain. To accomplish the desired results, there should be at least two 25 watt lamps to each 20′ x 20′ house—40 watt lamps would probably be better. This is a matter of opinion. The lights should run through the middle of the house, and, if there is a purlin, should hang just below this purlin and not be in front of it, otherwise a shadow will be cast upon the perches. Some poultrymen use drop lights, having them drop to within three feet of the floor. This also throws the perches in a shadow. If the size lamps given above are used and they are placed as directed, the light will be strong enough for the birds to see the grain in the litter and the perches will not be in a shadow.

When installing the lights, some sort of time switch ought to be installed, so that it would not be necessary for the operator to get out of bed at 3: 30 every morning if he wished them turned on at this time. Such time switches may be bought, but are rather expensive. One just as good may be rigged up from an ordinary alarm clock by placing it so that the winding key comes

in contact with the lever switch; when the alarm goes off, the key turns and pushes the switch over. This switch is not needed if what is known as the "evening lunch" method is followed, and need not be used if the lights are supplied all in the evening. It is needed, however, if the lights are supplied all in the early morning or half in the early morning and half in the evening.

Operation

The birds should not be given more than fourteen or fourteen and a half hours of light, as more than this will break them down and they will be in worse condition than if they had been left alone to come into laying normally. To accomplish this, the lights are turned on for the length of time which is equivalent to the difference between the amount of natural daylight and fourteen or fourteen and a half. Of all the methods mentioned above for turning on the lights, the early morning system, evening lunch system and the evening systems are those that are used by successful poultrymen, and of these three, the first is the most popular.

Where this system is used, the lights are turned on at four in the morning about November first and turned off at daylight. The lights are gradually turned on earlier each week so that the birds will get fourteen hours of light. This is kept up until about April first, at which time the lights

are gradually shut off—about ten minutes later each day until they are off entirely. Where the evening method is used, lights are turned on at dusk and kept on until the birds have fourteen hours of light. Under the evening lunch method, the birds are allowed to go to roost normally and are called down off the perches at eight or nine o'clock by switching on the lights. The lights are left on for one hour, at which time they are turned off.

As I said before, the feed is the important factor, so don't forget to feed them. Where the early morning method is followed, the birds may be fed either in the early morning, when the lights are turned on, or, which is more convenient, after dark for the next morning, so that the birds will find the grain on the litter when the lights come on. Following is a schedule which can be used for feeding birds under lights, using the early morning system. By the late feeding is meant the feeding to be given after dark, after the birds have gone to roost, so that they will have it the first thing in the morning when the lights come on. The amounts given are the number of pounds per hundred birds:

Month	9 A. M.	4 P. M.	Late	Total
September	4	5	3	12
October	4	5	3	12
November–February	5	5	4	14
March	4	5	3	12
April	4	6	...	10

I have given the rations for September and October, since some like to put the lights on their early hatched birds at that time. As a matter of fact, if early hatched birds are to be put under lights to prevent molting, this is the time to do it. When the lights are cut off, the extra feeding stops, of course. The dry mash is kept before them all the time, so that they may eat it as they will—it is only the grain that is fed according to schedule. The amounts of feed recommended in the above schedule are more in the nature of suggestions, as it may be necessary to feed more or less depending upon the condition of the birds.

When the evening lunch method is used, the birds are allowed to go to roost as usual, but are awakened about nine o'clock by switching on the lights. The lights are left on for an hour, at which time they are shut off. They are not turned on until the follcwing night, the birds being permitted to arise at dawn and retire at dusk as per the normal schedule. The advantages of this system are that they are probably under closer watch than with the other methods, as a poultry keeper will generally take care of them himself at night, but will not get up very often at 3: 30 or 4 A. M. to see how they are doing. Also, in winter time, water is likely to freeze if left all night—and the birds should have water the first thing when lights are turned on in the early morning. When the evening lunch method is followed, the water may

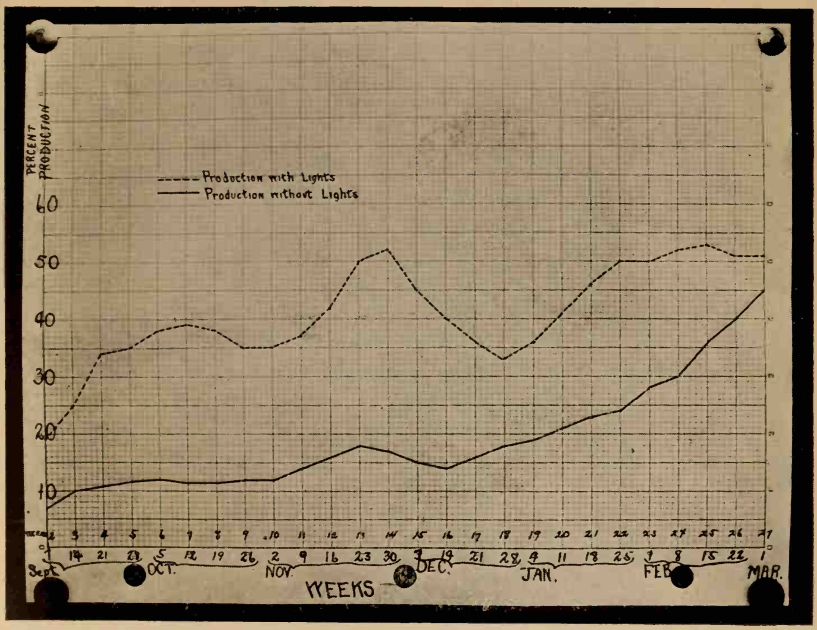


Plate XVIII. Showing what happens when lights are used wisely in the laying house in fall and winter

be given the birds and the pans emptied when the lights are turned off, thus preventing freezing. The following schedule may be used in the evening lunch method:

Month.	A. M.	P. M.	Evening Lunch.	Total
September–October	4	6	2	12
November–February	5	7	2	14
March	4	6	2	12
April	4	6	...	10

The figures given under the different headings are the number of pounds per 100 birds. The lights are turned off the first of April, so extra feeding is not needed after that time. It may be found about that time that production will drop slightly; if it does, merely let the birds run outside. The result will probably be that, after a couple of weeks, the birds will come back and lay a goodly number of eggs. The birds must be watched carefully all the time to see that they are maintaining their body weight; if they are not, a larger amount of grain must be fed than that recommended above.

When run wisely, lights are very profitable—the cost of the electricity for the season will not be more than five cents per hen, the price of one egg. Great care must be exercised, however, and it must be remembered that the whole lighting problem is a feeding problem pure and simple and must be treated as such. The birds must be looked after every bit as much as they are during

the day; if they are, they will respond. It will take only about ten days for the effects of the extra feeding to be felt—it will take less to show the effects of poor handling. Watch them. Don't depend too much upon the time switch.

CHAPTER XI

CULLING OUT THE NON-LAYERS

THE months of July, August, and September find the poultryman with a large number of non-laying birds on his hands, which to say the least are anything but profitable. The question is to find out which birds are laying and which are not, and to dispose of those that are not as soon as possible.

Fortunately, there are means at the disposal of the poultryman by which the laggards may, with a very slight percentage of error, be discovered and eliminated. There are certain characteristics, such as the color of the skin immediately surrounding the vent, the color of the ear lobes—in the Mediterranean or light breeds, the color of the eye ring, the color of the beak, the color of the shanks, together with the color and texture of the comb, condition in the region of the pelvic bones, and individual constitutional vigor, which serve as an index to the laying ability and present condition of a hen. A consideration of these various characteristics in the case of a Leghorn pullet will show how a combination of them all may

be used to tell the present laying condition of a bird and what she has done since she has started laying in the fall.

When a Leghorn pullet reaches maturity in the fall, she has bright yellow shanks, yellow beak, yellow skin around the vent, and a high degree of yellow in the ear lobes, as well as yellow eye rings. When she begins to lay, she puts the material which goes to make up this yellow pigment into eggs rather than into her skin, and as she continues to lay, the drain upon her system becomes greater, causing the yellow pigment to fade out in all noticeable portions of her body. Happily, there seems to be a definite order with which this yellow pigment disappears from the various sections of the bird's body. The vent is the first section which begins to fade out, the color disappearing after the pullet has laid consistently for five or ten days. Shortly after the vent becomes white, the eye ring, just inside the eyelid has also become white. After she has laid continually for three weeks or a month, the ear lobes become white, removing all trace of yellow, and after two months' laying, the beak loses its color, with possibly a small amount remaining at the base. After three to five months of steady laying, the color disappears from the shanks, so that by this time the bird has white skin surrounding the vent, white beak, and white shanks.

Luckily for the poultryman, the yellow pig-

ment appears in exactly the same order in which it disappears, making it easy to tell as soon as a bird has quit laying. For example, if a bird stops laying the yellow reappears in the skin right around the vent in the first five or ten days, then in the eye ring, then in the earlobes, then in the beak, and finally in the shanks. As a bird which stops laying at this season of the year, that is, about July, seldom comes back into laying condition for three or four months, it is safe for the poultryman to dispose of such a bird as soon as she stops. Any statements about time to cull and season of the year in this article refer only to birds that have not been under lights. I will say this, however, that birds that have been under lights may be culled the same as birds that have not, but the birds that stop laying after having been under lights may be brought back to laying condition in late summer by turning on the lights for a while. It would seem wise to bear these points as to a poor hen in mind and cull out durthe year whenever possible, for a bird that will not lay when under lights will probably not lay at all. Various flocks under lights will act differently, so it is impossible to set any other definite time for a systematic culling other than the summer time.

Capacity and Vigor

In addition to the above pigmentation tests, the constitutional vigor and capacity of the bird to

produce eggs must be taken into consideration. A sick bird is not profitable to keep, for even after recovery, she seldom produces as much as she did before, and should not under any circumstances be kept for a breeder. A hen must be strong, with an abundance of vigor, and of high vitality, for the steady production of eggs is a tremendous strain upon the system, and only those birds which have a high degree of constitutional vigor can stand up under it. Obviously, a bird which is light in weight is not well, and should be discarded, for she is evidently not capable of supporting her own body, and surely if she can't support her own body, she can't produce eggs. On the other hand, it is not desirable to keep a bird which is too heavy, for she is doing either one of two things: she is either putting all her food on her body and producing no eggs at all, or she is producing egg yolks which are being absorbed by the body—a common occurrence due to the wall of the oviduct being weakened, allowing the yolks to break through into the abdominal cavity. It is highly desirable, then, to keep only such birds as approximate standard weight. This can easily be determined in the handling of the birds, and is a factor which should not be overlooked.

The dairyman in selecting a high-producing cow looks for a long barrel as indicative of capacity and high production. Just so with the poultryman: he looks for capacity. In the case of the

hen, however, capacity to produce eggs is shown more by the distance between the lay bones and the pelvic arch, than by the length of body. If a hen has a long pelvic arch and a big distance between lay bones (the width of two or three fingers), she may be expected to have the capacity for producing eggs. Depth through the body as measured from the front of the keel line through to the back, is also a good measure of capacity. Along with the space between lay bones, the length of pelvic arch and depth of body goes the texture of the lay bones. Lay bones should be thin and pliable, permitting the egg to be laid with ease, rather than hard and thick, showing that it is a difficult matter for the hen to deposit the egg. Many poultrymen use this as a guide in selecting their flocks of winter layers. The skin should also be soft and pliable.

Texture and color of the comb are other factors which bear consideration at time of culling. A large comb is not necessarily an indication of high production, but a fairly large comb of a bright color and a fine texture, having an oily feeling, is an indication, and with the other factors mentioned above aids in selecting the layers from the non-layers. When a bird stops laying, her comb becomes dull red in color, hard to the touch, and shriveled. This factor, then, in addition to the pigmentation test and constitutional vigor test, may be taken as an indication of a

bird's laying condition. All factors should be considered together at all times in culling.

How and When to Cull

To be done to the best advantage, culling should take place in the daytime, as the color of the yellow pigment cannot be discerned so readily at night as in the daylight. A good many farmers, however, use a flashlight with a daylight bulb, which may be purchased at some stores. This method is used with some success. It is a very good plan to catch the birds at night, putting them in coops until the next morning, at which time culling may be done efficiently. The birds may then be sent to market and a neat little sum obtained for them—this in addition to the amount saved in feed, which is no small item. As it is often necessary to cull out from one-third to one-half the flock, it can be seen what a saving is realized in the amount of feed necessary to maintain the remainder of the flock, and what may be realized from the sale of the culls for meat, at the same time obtaining the same egg production as that obtained before the removal of the culls. Beginning with July and continuing through September, birds will stop laying and will not come back until late October and November and sometimes later, at which time the pullets that are to form the winter flock are laying. Since a good flock of pullets is generally assured, all old birds

A handy catching coop that may be used in catching up the birds preparatory to culling (see chapter XI)

Plate XIX. "The end of a perfect cull" (see chapter XI)

except those wanted for breeders, should be disposed of as they stop laying. In order to cull to the best advantage, catching birds as soon as they stop laying, the above mentioned facts should be used as a basis, and the flocks gone through every two weeks during July, August, and September. Every poultryman owes it to himself to dispose of all birds that are not laying, thereby making a saving in feed and at the same time maintaining his production.

The following figures given me by the Extension Specialist in Poultry Husbandry in New Jersey show the value and necessity of culling. In culling demonstrations which were given throughout the state during a recent summer 7,532 birds were culled and sent to market, or 47 per cent. of the entire lot, thus cutting the feed bill practically in half, while the production for the week previous to the culling was 33 per cent. and for the week after the culling was 32 per cent.—practically the same. The story is a simple one and the poultryman's duty plain: a reduction of 50 per cent. in the amount of feed consumed without reducing the production, resulting in a saving of money, and a definite amount of cash to be realized from the sale of culls. Cull early, often, and throughout the summer.

CHAPTER XII

PACKING THE MARKET EGG

"I HAVE never had a complaint of breakage due to faulty packing." Thus spoke Gustav Walters of Vineland, New Jersey. How many other commercial poultrymen, keepers of farm flocks, or "backyarders" can conscientiously make a statement similar to this? There are thousands and thousands of dollars lost by the poultry industry each year from poor packing, due either to ignorance of proper methods or to carelessness. Were care used in packing, this loss could be greatly minimized.

Upon the conditions under which eggs are produced depends, to a large extent, the quality or character of eggs which are shipped to market.

In the very first place, it should be the aim of the producer to produce only infertile eggs. Naturally the only way to do this is to remove all males from the pens producing market eggs. The eggs produced after the removal of the males will contain no fertile germs and will never, therefore, develop chicks. These infertile eggs will not decay so rapidly as the fertile eggs when exposed to adverse conditions.

Apparently very few owners of farm flocks seem to realize the importance of selling only clean eggs, for large numbers come into the markets and bring from four to eight cents a dozen less than clean eggs of the same grade. With a little extra care, clean eggs can be produced in place of dirty eggs at an increased profit to the owner. The way to produce eggs is to have clean, comfortable nests in the laying house, with clean litter in each one, such as shavings, straw, hay, or sawdust. In wet weather birds should not be allowed outside. Frequent collections will also eliminate dirty eggs as well as spoiled eggs.

A Homemade Candling Outfit

No one likes a rotten egg, consequently no one is going to buy one—not even the commission dealer. Many farmers do not care whether their hens steal their nests or not and do not bother to hunt for the eggs until market day comes round. Once a week is sometimes as often as eggs are looked for. Any eggs that have come from an old nest or that in any other way look suspicious should be candled at home before sending them to market. A practical homemade candling lamp may easily be made by cutting a hole about the size of an egg in the side of a small length of stove pipe. Set a small oil lamp inside of the pipe and adjust the pipe so that the hole is opposite the light. Light the lamp and hold the

egg up to the small hole in the pipe so that the light shines through the egg. A fresh egg will be absolutely clear except for the yolk, which will be of a dull orange color; an egg giving any other kind of appearance should not be sold. Especially in warm weather are eggs likely to spoil. The man on the commercial plant may well look to it that none of his decay. Keep all eggs out of the sun and don't hold any in a warm room—the cooler the room the better. Don't hold eggs longer than two or three days, especially in the summer time, although they may be held a week in cool weather.

The selection of eggs which are to be sold is important and is a matter which is entirely under the control of the owner; certain factors in the production of eggs may not be directly under his control, but the selection of the eggs—the decision as to which eggs are to be sold—is entirely in his control. In the first place, make it a point to use for home consumption eggs which if sold would be apt to bring a price lower than the price received for the best eggs sold.

How New York Grades Eggs

All ill-shaped eggs, cracked eggs, and dirty eggs should be separated from the others, and the remaining eggs graded according to size as "firsts" or "seconds." Even if dirty eggs are cleaned, they are cut in some markets the same

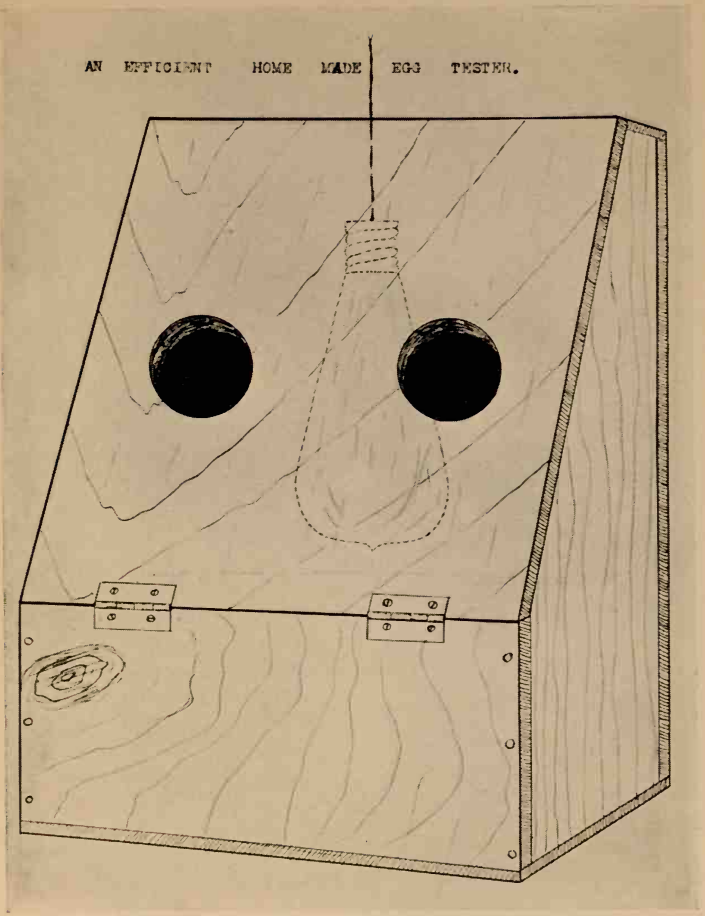


Plate XX. A home made candling device which serves the purpose very well

as though they were dirty. This is because the characteristic rough surface of the egg is removed and becomes smooth by washing, giving a shiny appearance. This is not wanted by a high-class trade.

The various grades of eggs as recognized in the New York market, and the relative prices quoted for each may be seen in the following quotations given in *The Producer's Price Current* for February 17, 1922:

Fresh gathered, extras, per dozen	.43	@
Fresh gathered, extra firsts	.41	@42
Fresh gathered, firsts	39	@40
Fresh gathered, seconds		@38
Fresh and held undergrades		@
Fresh gath., dirties, regular packed. No. 1	35	@36
Fresh gathered, dirties, No. 2 and poorer	33	@34
Fresh gath., checks, fair to choice, dry	33	@34
Checks, undergrades	30	@32
Refrigerator, firsts		@
Refrigerator, seconds	32	@34
Refrigerator, undergrades	27	@31

NEARBY AND WHITE EGGS

Nearby and nearby western, hennery whites, extras		@48
Nearby and nearby western, hennery whites, extra 1sts	46	@47
Nearby and nearby western, hennery whites, 1sts	44	@45
Nearby gathered whites, 1sts to extra 1sts	44	@46
Nearby whites, undergrades	41	@43
Nearby white pullets, gr'd, smallest out.	41	@42
Nearby pullets, unassorted		@40
Pacific Coast, white, extras		@48
Pacific Coast, whites, extra firsts	46	@47
Pacific Coast, whites, firsts	44	@45
Pacific Coast, whites, undergrades		@

Pacific Coast, pullets, graded, smallest out	41	@42
Pacific Coast, pullets, usual packing		@40
Other west'n and s'th'n gathered whites	41	@46
Nearby and nearby western, hennery browns, extra	44	@45
Nearby brown and mixed colors, gath'r'd, graded, extras	43	@
Nearby brown and mixed colors, firsts to extra firsts	40	@42
Nearby seconds	38	@39

It is a very good plan to sort and grade the eggs and do as Mr. Walters does. He says: "All seconds or small eggs are put in the top layers of the crates and the number of dozens of same is marked on the shipping tag—which is always nailed to the end of the crate—for the wholesaler's benefit." This is a great timesaver for the wholesaler—he probably won't candle that crate of eggs, but he will make returns according to the shipping tag.

After a producer has shipped a few times to a certain wholesaler or commission man, it doesn't take that wholesale merchant long to become familiar with the quality of eggs which that particular producer sends in. If the producer is careful and honest, grades his eggs and sends in uniform shipments each time, the commission man may candle only a few eggs in each crate, or he may not candle them at all. On the other hand, if the producer is not careful and honest, if he does not grade his eggs, if he grades them sometimes and not others, or if he tries to "slip something over" on the wholesaler by slipping in

small eggs with large ones, the wholesale dealer is compelled to candle every case. In such cases he is likely to be very critical. It pays to work up a reputation and *to live up to it.*

The packing of a crate of eggs for shipment is where a good many fall down. The lower picture on Plate XXI shows very well the effect of poor packing as well as improper handling in transit.

This case of eggs was shipped via parcel post from a town in Maryland to a wholesale dealer in New York. It arrived in the condition shown. Of the thirty dozen which started from Maryland, eleven and a half dozen got to New York completely broken—a dead loss—and fourteen and a half were cracked and stained, while only four dozen of the whole lot got there in good shape. This certainly is an object lesson for all producers and shippers of market eggs.

I asked Mr. Walters how he packed eggs for market.

Shipping by Parcel Post

"The eggs are always put in the fillers little end or pointed end down," he answered, "any eggs that might be larger than the average—not including double-yolked and unusually large ones—are placed on the outer side or corner places and tilted slightly down, so that the flat and eggs above them will not strike and break them. When the crate is full of eggs, I put a flat on top of each side, fill with excelsior or folded newspaper the quarter

inch space to top of crate, and nail the top lid on securely at both ends, also using one nail one inch from each side over center of partition. I have never had a complaint of breakage due to packing."

To complete a case for shipment via express, it must be wired around each end with wire a little finer than bale wire. The wire is held in place by looping it around the small nails that are driven in the top, sides, and bottom. These nails, of course, are hammered down hard.

C. N. Warner of Toms River, New Jersey, when asked how he sold his eggs, replied:

"My eggs are selected as to size and shape, the smaller ones going out in strawboard fillers in a standard egg case, while the selected eggs are packed in two-by-six cartons, blue-lined when we can get them, and packed thirty dozen in a special case made of white wood by a carpenter on the place. These cases are varnished, stenciled, and trimmed with brass fastenings. These are, of course, returnable, and give some free advertising coming and going. We make sure that long eggs are tilted at an angle, so as not to press hard on the egg below or above, and if there is any space outside the filler or cartons, this is filled to prevent shaking. I have been more fortunate than some, I think, regarding loss due to breakage in shipment. Every egg when packed is clicked with another to see that none go in that are cracked."

Marketing eggs by parcel post is a practice

Type of crate used in high-class carton egg trade. It is strong and well built, capable of making many trips

Plate XXI. An object lesson in poor packing and worse handling. Out of thirty dozen eggs shipped from Baltimore, only four dozen reached New York in good condition

which is not carried on so extensively as any of the other methods of disposing of market eggs. This may be due to several factors; among them, rough handling at the hands of the postal authorities, improper methods of packing, and the slightly increased price which must be charged to meet the expense of selling this way. Opinions are divided on the subject, but I think nearly all will agree that it does not pay unless a lot of it is done, due to the labor involved.

Harry H. Ober, of Lakewood, New Jersey, who has had considerable experience in marketing eggs by this method—this being his fifth year at shipping eggs by parcel post—was asked his method of packing eggs. He started out using paper boxes. The plan was to charge the customers ten cents over the market and the postage, no charge for the boxes, and the customers to return the boxes. This plan proved unsatisfactory, however, owing to the fact that the customers did not return the boxes as they should. Accordingly, he inaugurated another plan which he describes:

"I have purchased a light metal egg crate for each customer, which runs in price as follows: Two-dozen size at eighty-five cents, three-dozen size at one dollar, four-dozen side at $1.25, and six-dozen size at $1.75 each. We charge the customer according to the size. We pay the postage on the eggs and charge ten cents above wholesale market price."

The customer pays return postage on the crates which are refilled as often as they are returned. The price of the box is refunded when the customer discontinues buying. Mr. Ober says the plan is working well.

As to the method of packing, Mr. Ober says:

"We use newspapers cut into eighths, roll the eggs in these papers, and put them in the filler especially made for the box. Since the paper is a little longer than the egg, it forms a cushion when it is put in the filler, and also leaves some paper sticking above the filler so that when the flat, or cover, is put on, a cushion is formed on top of the eggs. The percentage of breakage is less than one per cent."

No allowance for breakage is made, as the best box on the market is being used and the best method in packing the eggs is being followed.

There are great possibilities in the parcel post egg trade, but the main disadvantage seems to be in the labor involved in handling the many parts to each package. Danger of breakage can be eliminated, as Mr. Ober has done, by procuring a strong and durable container and by using great care in packing each egg. The writer has had some experience recently in shipping eggs by parcel post. He shipped seventeen dozen eggs in small pasteboard boxes, each box containing a dozen eggs, and had only one egg out of the whole

An outdoor hopper which may be used satisfactorily (see chapter XVII)

Plate XXII. The absence of a rooster from the flock will mean infertile eggs which are advised for home preservation (see chapter XIII)

seventeen dozen broken so as not to be usable; two others were cracked but were usable.

Four Marketing Rules

The method of marketing eggs is a question which faces every producer. The manner in which he is to sell his eggs depends altogether upon local conditions, the time he has at his command, and the labor involved in marketing. If a poultryman is so located that he can supply the near-by retail trade and has the time to spend marketing his eggs in this manner, it would probably be advisable for him to dispose of his products locally. On the other hand, if the poultryman is rushed with work, running the poultry end of his farm merely as a sideline, and not having time to spend working up a trade or packing cartons or parcel post packages, it would undoubtedly be advisable to crate his eggs and send them to a wholesale commission dealer. It may even be advisable for many western farmers to send their eggs to the eastern markets, such as New York, especially in the seasons of high prices. By selling in case lots the poultryman is thus freed from a lot of care and bother and receives sure returns for his produce—although somewhat less than he would receive at retail. Another reason why some poultrymen do not want to bother with private trade is bad debts, which very often are annoying and amount to

quite an item. These matters are all personal matters which must be worked out by the individual himself, although he may get some assistance from the experiences of others.

The main items in the market-egg trade may be summed up in a few short sentences:

Produce eggs of good quality.

Select eggs carefully before marketing.

Use great care in packing eggs for shipment.

Endeavor to establish a good reputation with your customer, and once this reputation is established, live up to it.

Since the above was written, one or all of these men mentioned may be marketing their eggs through the New Jersey Poultry Producers' Association. If they are, the different packs mentioned are not used, as the Association packs its own eggs. However, the methods of packing just described were all used successfully for years.

CHAPTER XIII

HOME PRESERVATION OF EGGS

"How can Mrs. Peecher afford to bake so many cakes and make so many custards when eggs are so high?" a neighbor asked the other day. "Why, with eggs at eighty-five cents a dozen, I just simply have to cut down on the number I use." The neighbor did not know that Mrs. Peecher was using "canned" eggs, or "pickled" eggs, or preserved eggs, as they are variously called. She was wise and knew how to make use of the low priced eggs in the season of high prices.

How can eggs at 40 to 50 cents a dozen be made to take the place of eggs at 75 to 80 cents a dozen or even higher? This is a question that will be asked countless times. The answer is a short one, namely, by home preservation of eggs. As the months of March, April, and May are the months of the year when eggs are the most plentiful, it is quite evident that those are the months when eggs are the cheapest; also, as October, November, and December are the months when eggs are the least plentiful, it is evident that these are the months when the price of eggs is highest. If

eggs, therefore, purchased at 40 to 50 cents a dozen can be saved for use when eggs are worth 75 to 80 cents a dozen, there is a manifest saving. That is exactly what was done by Mrs. Peecher, exactly what is done by many others every year, and what should be done by a great many more.

Eggs are preserved in two ways; by placing them in cold storage or by using some liquid or paste preservative. The former method is employed by the commission men of the larger cities, where there are cold-storage houses, the eggs being put in storage in April and removed in late August, September, and early October—sometimes not until later—resulting in a more equal distribution of the egg supply throughout the year. This practice admits of somewhat lower prices in late summer and early fall for eggs which are nearly as good as fresh eggs. The latter method is employed by the housewife or individual consumer. This is probably the better way of preserving eggs, as the consumer can tell just what kind of eggs is being preserved, and the few cents profit per dozen of the commission man—in the cold storage method—is saved.

Methods of Preserving

There are two methods by which eggs may be preserved for home consumption; one is by means of water glass—sodium silicate—and the other is by means of a high melting point vaseline or other

pastes. For the first method a large earthen crock should be procured—a good size being a four-gallon capacity, which will hold about ten dozen eggs. The crock should be washed and sterilized with boiling hot water. To make the preserving solution, add nine parts by volume of water—previously boiled and later cooled—to one part of sodium silicate. The eggs may then be placed in the crock, small end down to keep the contents of the egg in normal position, and the solution poured on the eggs, care being taken to cover the eggs completely, for eggs will spoil if not completely covered. Put the lid on the crock and set away in a dark, cool place. To remove the glassy coating on the eggs when ready to use them simply wash with a damp cloth. They may be used when desired, taking them from the crock as they are wanted; they do not have to be used all at the same time.

If a person with a small flock wishes to preserve eggs, he need not be discouraged because he gets only a comparatively small number of eggs a day—he may put the eggs down in water glass as he gets them. In other words, it is not necessary to preserve them all at once, as a good many think is necessary. As long as those that are preserved are kept completely covered, there will not be any danger. However, it is much more desirable as far as the labor is concerned to do them all at once.

The other method by which eggs can be preserved for home use is to coat the surface of the egg with some pasty substance, such as a high melting point vaseline. A good preservative which can be made at home with comparatively small cost, is one composed of two parts of white vaseline and one part paraffin. Heat these substances until they are in liquid form, then mix them thoroughly. Allow to cool and your preservative is ready for use. There are several commercial preservatives of this nature on the market which are good and at the same time inexpensive. A small portion of the preservative is rubbed between the hands until they are sticky. Each egg is then rubbed between the hands until the surface is well coated with paste. The egg should then be wrapped in a small piece of soft paper and placed either in an ordinary egg crate or in an egg carton. The crate or carton should then be set away in a cool, dry, dark place. This method involves more labor than the water glass but is equally efficient. Both methods are inexpensive, costing only a cent or a cent and a half a dozen to preserve the eggs.

Kinds of Eggs to Use

Whichever method of preserving eggs is used, the eggs must be good—they must be infertile. When the consumer buys eggs for preservation, he should be very careful to get only infertile eggs,

as well as should the producer of the eggs. Fertile eggs could, of course, be used, but they are much inferior to the infertile eggs, because there is the possibility of germ development with the consequent spoiling of the eggs for consumption. Infertile eggs will never contain a developed germ, are slow to decay, and cost no more than fertile eggs—in fact, they cost less to produce on account of the absence of the male bird. Cracked eggs, dirty eggs, and thin shelled eggs should never be used, for if one egg is broken in the preserving solution it decays and spoils the rest of the eggs in the container. Old eggs should not be used—only strictly fresh, not older than a week. The age of the eggs can be ascertained with a fair degree of accuracy by the housewife before preserving. This can be done by candling. A home candler can easily be made similar to the one shown on Plate XX. By holding the egg up to either of the small openings of the box the light will shine through the egg, enabling the candler to see the size of the air cell and detect the presence or absence of blood spots.

In an egg that is strictly fresh the air cell appears about one-half an inch wide and one-eighth of an inch in depth. Only strictly fresh eggs should be used. If the air cell is larger than one-half inch, the egg is old—the size of the air cell increasing with the age of the egg. Eggs containing blood clots should not be used for preser-

vation. If a blood clot is present, the egg has a dark, cloudy appearance. Eggs should not be washed before preserving as this opens the pores of the egg, allowing quicker evaporation of the water in the eggs. In buying eggs for this purpose it is best to order them from some reliable poultryman, placing the order several weeks ahead of time, so they will be ready and available when desired. A good plan is for several purchasers to club together and buy eggs by the case. A slight amount may be saved by buying in large quantities, and it is much easier to ship eggs in crates than in smaller packages.

Eggs which have been preserved by the methods described above can be used for nearly any purpose. To be sure, they will not stand up quite so well as fresh eggs, making it a trifle difficult to separate the yolks from the whites. When it is desired to boil eggs thus perserved, a pin-hole should be pricked in the large end of the egg to prevent cracking the egg-shell. Eggs thus preserved will keep from nine to eleven months; as a rule, however, they should be kept only from the spring months to the late fall months—that is, from the time the "egg crop comes in" until the period when eggs are scarce. This advice concerning the preservation of eggs is not meant entirely for the city consumer, but for the poultryman and keeper of a farm flock as well. Why shouldn't the farmer put down a couple of crates

of eggs in the spring and sell the eggs he gets when the price is high instead of eating them? I mean eggs for cooking, of course, as we all like fresh eggs for breakfast. A little extra labor and a few cents will save anywhere from fifteen to twenty cents a dozen or more; quite an item in a family where a large number of eggs are used. Is it worth it?

CHAPTER XIV

SELECTING THE BREEDERS

Late fall or early winter finds the poultry keeper mating up his pens for the season's breeding. He has been, or should have been selecting his birds all along, sizing up their good qualities and their bad, keeping the ones which showed good possibilities and discarding the ones which gave no promise whatever of being good breeding stock. No matter whether the poultryman is selecting his breeders for showroom stock or for utility stock, the prime considerations are vigor and vitality. A bird may have a wonderful ancestry with wonderful records back of it, yet of what use is it to breed from this bird if it is not healthy and vigorous? What is wanted is a bird that will produce fertile eggs, which in turn will produce healthy and vigorous chicks; but these results will not be obtained from birds with low vitality.

Evidences of vigor and vitality in the male may be seen in a well-proportioned and well-set body, good carriage, bright eyes, bright and erect comb, and well-shaped head. Good-sized legs with a wide distance between them are also evidences of high vitality and vigor. A scrawny-looking male,

Plate XXIII. A male showing low vitality . . . don't use him

one that is narrow-breasted, has a crow-shaped head and a drooping tail will not produce many healthy chicks. The male bird is half the flock and should therefore receive a great deal of attention when the pens are being mated up.

By experimentation it has been found that the egg-producing ability is transmitted to the progeny through the male bird. It is, therefore, advantageous when selecting the breeders to choose the male birds whose mothers were good producers. This does not mean that a high-producing flock may be obtained by mating poor hens to males whose mothers have been high producers. What should be done is to mate high-producing females to males whose mothers have been high producers and obtain as progeny females that will be good producers and males that will be useful as breeders to other flocks. When no pedigree records are available the external characteristics mentioned above will have to be relied upon.

Choose Hens with Perfect Health Records

A very good plan to follow in selecting the breeding males, when the equipment and circumstances permit, is to set up a few exhibition coops and place the males in them. By having all his birds before him the poultryman can compare one with another. After selecting, say, twenty of the best—the number, of course, depending upon the number of breeders desired—he may put these in

coops by themselves and select the best from this number; and so on, by the process of elimination, until the required number of male birds has been obtained for the pens.

Just as the male bird must have a healthy and vigorous appearance and must be purely masculine, so must the female be healthy and vigorous and present a purely feminine appearance. She must have a neat, trim body, showing capacity for production—that is, wide in the pelvic region and between the pelvic bones or lay bones, as they are sometimes called, with a long keel bone and a wide pelvic arch. She should, further, have a wide back, and should have good depth of body as measured from the back through to the keel bone. She must not be awkward nor rangy in appearance. Above all, she must be healthy—it does not pay to breed from a bird that has ever been sick, for the weakness or tendency towards the weakness is apt to be transmitted to the offspring, and unhealthy chicks will be the result. A hen with a neat head, a bright eye and a bright flexible comb shows vitality and can be relied upon, if possessing the other points mentioned above, to be a good choice for the breeding pen.

In choosing the female breeders do not select pullets. The pullet year, in most cases, is the year of maximum production, in which the birds are given the feed that will produce the largest

number of eggs. Obviously, the proper nourishment for the developing germ cannot be put into the egg while forcing feeds are being fed. This is one cause of the poor-looking chicks obtained from pullets. Further, it is quite generally accepted in all branches of animal breeding that progeny from more mature stock is likely to be more healthy and vigorous than is progeny from immature stock. Just so with poultry; the breeding stock is more mature if it has had a chance to molt and rest after a hard season of egg production. This is why hens are recommended in preference to pullets as breeders.

There are several different systems of mating birds, one of which is known as the large-flock system of mating. In this system a certain number of males is placed with a large flock of females, the number of male birds depending upon the size of the flock. There is also the small-flock mating, which consists of placing one male in a small pen of females. A disadvantage of this system is that often the male bird will practice selection, mating with only certain birds and thereby causing eggs from other birds in the flock to be infertile. Again, there is a system known as stud mating, in which the male bird is kept confined and the hens are brought to him one at a time. The traveling-male system is just the opposite of this, the hen being confined to a run by herself and the male bird carried from pen to pen. A

system which is popular among some breeders is the system of alternating males: Two males are used for one small flock, one being in the pen one week and the other the next week, and so on. This eliminates to some extent the possibility of selection by the male bird.

Large-Flock System Requires Least Care

Of all these systems the large flock, the small flock, and the system of alternating males are the most commonly used. The large-flock system requires, perhaps, the least care of any and gives as good results as any. This is really the only system to use where buildings and yards are limited —provided, of course, that all the birds come up to the standard set by the poultryman. In other words, if a hundred breeders are to be kept, and they all give evidence of being good producers and are in good condition, there would be nothing gained, as far as the breeding results are concerned, by placing ten hens in a yard and making ten pens of them, when as good results could be obtained by having them all in one yard.

Generally, one male bird is placed in the pen for every ten hens—in a small flock. For large flocks, this proportion may be changed to one to twenty. There is more chance of obtaining fertile eggs from a large pen of this sort, as it is not likely that the same hens would be neglected by all the cockerels. Of course, to be on the safe

side, this ratio could be made one to fifteen. A good many poultrymen, however, use one to twenty with good results. This proportion of females to males is generally used for Leghorns. For Plymouth Rocks, Wyandottes, Rhode Island Reds, and other heavy breeds the proportion is from one to ten to one to fifteen in large flocks and one to eight in small flocks.

Don'ts in Breeding

A summary of the principal points to be noted in the selection and care of breeders may be made in these few "don'ts":

Don't select any bird for breeding that has ever been sick.

Don't select any bird for breeding that is deformed in any way.

Don't select male birds that have come from low-producing hens.

Don't breed from pullets unless they are early hatched—January or February—and have gone through a molt before the breeding season.

Don't mate more than twenty Leghorn females to one male in large flocks (fifteen is a better number) and ten females to one male in small flocks; not more than fifteen heavy breed females to one male in large flocks (ten is a better number) and eight females to one male in small flocks.

Don't neglect to provide clean healthful quarters for the breeders.

Don't feed forcing feeds to stimulate egg production.

Don't feed fattening feeds.

Don't neglect green feeds; see that the birds get plenty of them.

Don't overlook exercise—it is absolutely essential.

CHAPTER XV

THE EGG AND THE CHICK

Of all the factors combining to affect the results of artificial incubation the stock is undoubtedly the most important one. A male bird which fertilizes none of the eggs or only a few at best, or transmits a weakened vitality to the chicks, is indeed worthless and is responsible for poor hatches, rather than the incubator in which the eggs are placed. In most cases, I believe, this trouble is ascertained fairly early in the breeding season and is remedied by the substitution of another male. However, the effect of the individuality of the hen upon incubation has been and is greatly underestimated.

If one does any pedigree hatching, he cannot help but notice that some hens will lay eggs all of which are infertile, while others will lay eggs which will die before the first candling, still others will lay eggs which will live until the second candling, still others will live until the twentieth or twenty-first day and will not hatch, while all or nearly all of the other hens' eggs will hatch healthy, vigorous chicks. None of the above re-

sults can be blamed upon either the incubator or the male bird, for in most cases the conditions of incubation are the same and the same male bird mates with all the hens. The following table will show the effect of the individuality of the hen upon incubation, from figures taken from the pedigree hatching records of the New Jersey Agricultural Experiment Station:

Hen No.	Eggs Set.	Infertile.	Dead at 7th Day.	Dead at 14th Day.	Dead in Shell.	Hatched.
12100	31	29	..	..	1	1
396	48	15	2	2	28	1
645	35	1	1	..	8	25
64	11	..	5	..	5	1
71	8	..	7	..	..	1
106	22	1	..	..	4	17
108	16	16	..	..	..	..
306	16	..	..	..	1	15

The effect of the individual hen upon the hatchability of eggs, then, may be easily seen.

In the case of the poultry keeper who trapnests his birds, it is an easy matter to spot the hens whose eggs show up poorly at candling or hatching time and eliminate them from the breeding pen. In the case of the poultryman who does not trapnest his birds there is one of two courses open: He may either install trapnests for a period of two or three weeks, thereby assuring an accurate way of ascertaining the poor hens, or he may, if possible, notice some peculiarity about the eggs which are continually infertile or dead, such as peculiar shape, color, mark-

ings, and so forth, and refrain from setting such eggs.

This latter method, of course, is possible only where there are some marked characteristics which are easily discernible, and cannot be relied upon to give accurate results. It is worth the poultryman's while to watch the results of the candling and to remove the birds which show up poorly, if possible, especially where hatching eggs are sold and a certain percentage of fertility is guaranteed. Herein is one of the greatest advantages of the trapnest and pedigree hatching. The importance, also, of healthy, vigorous breeding stock cannot be overemphasized when good results in incubation are desired. Therefore, great care should be taken in the selection of the breeders.

Clean Eggs Hatch Best

Good results in incubation are often lost because of poor methods of handling eggs before they are placed in the incubator. In the first place, to go back to the very beginning, eggs should be produced in clean quarters. Dirty eggs are very unsatisfactory for hatching, as the dirt clogs the pores of the shell, preventing the proper evaporation of the watery contents and the proper disposal of the carbon dioxide given off by the growing embryo. If the dirt is removed from the egg by means of washing, a certain glossy coating is at the same time removed,

thereby causing too rapid evaporation of the watery contents of the egg. To insure the production of clean hatching eggs, careful attention should be given to the four following points:

First, provide clean nests which are frequently replenished with clean nesting material, such as wood shavings.

Second, keep the nests clean by keeping them dark and by having some means of keeping them closed during the night to prevent the birds from roosting on them and dirtying them. This may easily be done by means of a hinged board in front of the nests.

Third, collect eggs often—at least three times a day—to prevent the birds from walking on them and dirtying them, or to prevent the possibility of the eggs being broken, thereby dirtying the nest.

Fourth, keep the birds shut in the house on days when the ground is muddy. This eliminates the possibility of the hens getting their feet dirty and tracking the dirt into the nests on the eggs.

Eggs should be collected often for other reasons than that mentioned above, namely, to prevent the danger of having them frozen in severely cold weather and to prevent the development of germs due to hens becoming broody and sitting on them. When the latter is the case, germ development starts and is checked when the eggs are collected and kept in a cool place. When the former is the

Courtesy N. J. Agricultural Experiment Station

Plate XXIV. A hollow tile incubator cellar, stuccoed inside and out. Plenty of ventilation is needed in the incubator cellar for good results in hatching

case, the eggs are so thoroughly chilled—and are even frozen in severe weather—that all chance of any germ development is lost. Frequent collections eliminate these possibilities.

Important Preliminaries

The conditions under which the eggs are held between the time of collection and the time of placing in the incubator affect, to a very large extent, the percentage of a hatch. Holding eggs at too high a temperature and too dry an atmosphere will cause a too rapid evaporation of the watery contents of the eggs, with the result that the size of the air cell of the eggs will be increased and the albumen of the eggs will become so concentrated that the developing chicks will not be able to assimilate it. The final result will be small chicks.

Again, there is the very great danger of a large number of the germs dying during the period through which the eggs are held when they are kept in a warm room. This is because the germs start to develop at a comparatively low temperature—68 degrees—and grow for a while, but as this is a much lower temperature than is needed for healthy, vigorous growth, the germs become weakened and in some cases die. A very large percentage of them will die when put in the incubator, due to the great change of temperature. A proper temperature at which eggs should be held

prior to incubation is between forty-five and fifty degrees.

Do not hold eggs longer than two weeks before placing in the incubator. Eggs held longer than this period will die in the early stages of incubation. It is also a very good plan while holding eggs to turn them each day during the period through which they are held. This prevents the germ from sticking to the shell and becoming lodged in one place. The above may very well be summed up in the following:

First, do not hold eggs at a high temperature; forty-five to fifty degrees is the maximum temperature for holding eggs for incubation.

Second, a slightly moist atmosphere is better than a dry atmosphere for holding hatching eggs.

Third, eggs should not be held longer than two weeks before placing in the incubator.

Fourth, turn eggs at least once a day during the period of holding. If the eggs are kept in a crate, the crate may be given a quarter of a turn each day.

Before starting the real hatching work of the season, the operator should see that the incubator is in the best of condition, and that the thermometer is working as it should. The latter may easily be tested by placing it in a pan of warm water together with a clinical thermometer or some other thermometer that is known to be correct. If the incubator thermometer does not register

correctly, discard it and get a new one. This is very important.

The incubator itself should be absolutely clean and in perfect working order. To clean, remove all movable parts, brush thoroughly and scrub with warm water. Next, set these parts in the sun to dry, and while they are drying brush out the interior of the machine and scrub it with warm water. Clean out around the lamp box, removing any soot which may be present. Clean the lamp, fill, and put in a new wick. In trimming the wick, great care should be used to obtain an even flame, not one that flares out at the ends, for this kind of flame gives very little heat and it smokes, causing the collection of soot. This may result in fire; so be careful about the wick. Replace the movable parts in the machine and spray with any good disinfectant. Then light the lamp and allow the machine to dry out. When a mammoth incubator is to be run, see that the same precautions are taken as to cleanliness and make sure that the stove is cleaned thoroughly and that the water that is put in the hot water system is clean water; it is not a good plan to allow the same water to stay in the machine that was in the previous season.

When the temperature rises to 103 degrees within the incubator, see that the thermostat is adjusted so that the lid on the top of the lamp box just rises. The thermostat is the most del-

icate part of an incubator and must be given a good tryout before placing the eggs in the machine. A mammoth machine must be regulated in the same way according to directions. Run the machine for two or three days before starting the hatch to see that the thermostat, lamp or stove, and so forth, are in good working order. If everything is all right, then set the eggs.

How Hot is Too Hot?

Temperature is probably the most important factor in incubation, and for this reason should be watched more closely than any other factor. The temperature may run in one of two ways: It may be held at 102 degrees for the first week, 102½ degrees for the second week, and 103 degrees for the third week; or it may be held at 103 degrees during the entire hatch. The former method will probably give the better results, but the latter method is easier, especially for the beginner, as it is rather difficult, unless one is used to operating incubators, for one to change the regulation of a machine half a degree. Under no conditions after the thermostat has been regulated at the beginning of the hatch, should it be tampered with, for this is supposed to have been done before the eggs were placed in the machine and the machine run for a couple of days as a tryout.

Other factors, such as too high temperature of

the cellar; high or improperly trimmed flame, or failure to follow the instructions for operating the machine as sent by the manufacturers, are responsible for high temperatures. The temperature will probably run high toward the latter part of the hatch; it is then permissible to regulate the thermostat. Of course, if the former method—that is, 102, 102½ and 103 degrees—is used, slight regulation must be made at the end of each week, but under no conditions should the thermostat be touched when the latter method, 103 degrees throughout, is used. No alarm should be felt if the temperature runs as high as 104 or 105 degrees near the end of the hatch, as there is a very large amount of body heat given off at this period which causes the temperature to rise. If this does happen, the regulator screw may be given a quarter of a turn and, if necessary, more moisture may be added inside the incubator. The temperature is very important and must be watched carefully.

Other Problems of the Incubator

Next to temperature in importance is turning. When the egg is at rest the germ comes to the side which is uppermost; it can readily be seen that unless the position of the egg is changed, the germ will develop in that one part of the egg. It will develop to only a certain extent, however, before it will become fastened to the shell. Hav-

ing once become fastened to the shell, it dies. This is why eggs must be turned at least twice daily—some recommend three times. The general method of turning is at morning and at night. In a small machine perhaps the easiest way to turn the eggs is to remove a few eggs from the center of the tray and to shuffle the remainder of the eggs round with both hands in such way that all the eggs are turned—in a sort of rolling motion. The eggs that were removed may then be replaced.

In mammoth machines, where the trays are small, the eggs may be turned by inverting an empty tray over a full one and turning the two trays over, at the same time holding both tightly. This method is a great time-saver. In many mammoth machines there are various patents for turning the eggs, most of which work well. The hand method, though somewhat the slowest, is by far the safest. Just a word may be added here as to those machines in which the eggs are turned by means of rollers that are cogged and rest on a grooved bar: if these rollers are made of metal, and the trays are watched carefully to see that they fit down snugly so that the cogged rollers will fit into the grooves of the long bar, this rolling device will work very satisfactorily.

The moisture problem is one which has been considered of vital importance. People have thought that in order to obtain good hatches

large quantities of moisture had to be given the eggs. As a matter of fact, not so much moisture is required as has been supposed. The main purpose in supplying moisture to hatching eggs is to prevent too rapid evaporation of the watery contents of the egg. How is one to tell just when the proper amount of evaporation has taken place? The answer is very simple: by candling the eggs often.

A fresh egg when examined in front of a candling lamp shows an air cell no larger round than, if as large as, a ten-cent piece. At the end of the first week the size of the air cell has increased to almost the size of a quarter, at the end of the second week it is a trifle larger than the size of a quarter, while between the second and third weeks the cell has increased so that by the eighteenth day it is as large as a half dollar and is nearly half way down the egg. Unless these approximate sizes are obtained, something is wrong. If the cell is too small, sufficient evaporation has not taken place; if the cell is too large, too much evaporation has taken place. It is therefore not advisable to do as has so often been recommended—supply moisture at certain definite periods of the hatch regardless of whether the eggs needed it or not. To be sure, eggs need moisture more along at the end of the hatch than they do during the earlier part, but sometimes the watery contents of the eggs do not evaporate so rapidly as

they should, owing to differences in the hardness of the shells; hard shells prevent rapid evaporatipn. Brown-shell eggs, for example, do not allow such rapid evaporation as do white-shell eggs.

When moisture is to be added to the eggs, it may be done in one of several different ways: The eggs may be sprinkled with lukewarm water by means of an ordinary whisk brush, or a pan of water may be set in the incubator, or a sand tray may be kept in the machine, or a pail of water may be set under the lamp, or the floor under the machine may be wet. It is impossible to tell anyone definitely without knowing the conditions surrounding the eggs and the incubator, just exactly how much moisture is needed and when. This depends upon weather conditions, the kind of floor there is in the incubator cellar, the kind of an incubator that is being run, the location of the machine within the cellar, and the way the eggs are behaving themselves, i. e., whether they are drying down properly. Each man's problem is a different one.

Cooling, considered by many to be of considerable importance, is not essential. Experiments have shown that as good results have been obtained with no cooling during incubation as with extreme cooling. The only advantage in cooling is in obtaining a heavier chick at hatching time. If any cooling is practiced at all, a medium amount

is to be recommended; that is, the eggs may be cooled each morning until they are just cool to the eyelid and cooled none at night. With incubators that have a direct current of air through them, that is, openings in the bottom and an opening in the top, no cooling is needed at all. It is necessary, however, that a moisture pan be kept in a machine of this type at all times.

Judge the Incubator with the Candle

Eggs are generally candled on the seventh and fourteenth days; on the seventh to remove any infertile eggs and any eggs the germs of which have died, and on the fourteenth day to remove any germs that have died since the seventh day. These eggs must be removed, otherwise the remaining eggs will be likely to be spoiled, as poisonous gases are given off which are injurious to the healthy developing germs. These dead eggs are also dangerous if the thermometer is placed on one of them, as the temperature on a dead egg is lower than on a healthy egg.

In addition to candling on the seventh and fourteenth days, frequent candlings should be made, as mentioned above, to ascertain the size of the air cells and the quantity of evaporation. These other candlings ought to be made after the second week, anyhow, and preferably every three or four days during the entire hatch. It is not necessary that every egg be candled—just

a few from each section of the machine to see how they are running.

Removing the Chicks

Chicks should not be removed from the incubator immediately; they should be allowed time to dry off thoroughly. This generally takes until the afternoon or night of the twenty-second day of incubation, as all the chicks do not hatch at the same time. Of course, this depends upon the hatch—it might come off a trifle sooner. Some chicks, to be sure, will have to be shut in longer than others—those that hatched first. They will get along all right, and it would only be harmful to the others that are hatching to open the door to remove them. On the night of the eighteenth day the incubator must be closed for the last time and not opened again until the hatch is completely over and the chicks are ready to be moved to the brooder. As soon as the eggs begin to pip, on the nineteenth or twentieth day, a piece of cloth, burlap, or heavy paper should be tacked over the door of the machine, so that the light will not attract the attention of the chicks and draw them to the front of the machine. If this were not done, the chicks would all crowd to the front and some would be smothered. When the chicks are to be moved all the brooders should be ready to receive them. The brooders should have been running several days. The chicks re-

Plate XXV. Hatch them right and give them a good start

quire no feeding for about forty-eight hours. After this the first feed should consist of something easily seen, such as rolled oats, for the first few feedings. Sour skim milk and fine chick grit should be kept before them all the time. After the first few feedings of rolled oats, a regular feeding schedule can be followed.

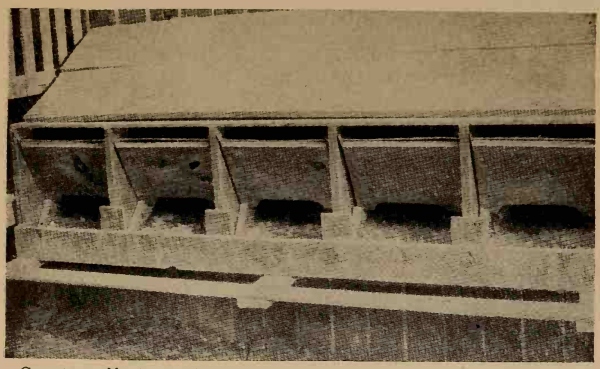
Why Drafts Cause Many Troubles

Fully as important as the selection of stock, care of eggs before hatching, and care during incubation is the location selected for the incubator. It should be kept in a room that is capable of good ventilation and that is free from drafts. Good ventilation may be obtained by having double windows, the outer one hinged at the top and swinging out and the inner one hinged at the bottom and swinging in. This provides for the breaking up of a strong wind or draft and allows a plentiful supply of pure air. In addition to this being a means of maintaining a constant temperature, it is a means of removing any impure air, such as oil fumes or coal gas. If oil fumes are allowed to remain in a room in which there is an incubator, there is danger of the germs being killed.

Drafts are perhaps the worst enemy of an incubator room and must be avoided, otherwise the flame may be made to flicker and smoke, resulting in either a fire or a spoiled hatch. This may be

avoided either by selecting a place for the machine which is protected from drafts or by building a screen for protection. The question of placing an incubator in the cellar of the dwelling house is purely a personal one, but there is always the danger of fire, and insurance rates are bound to be higher if machines are kept in the cellar of the house. There is also the danger from jars which may come from above, due to the slamming of doors. These jars, however slight, are likely to cause a change in the regulation of the incubator and thereby spoil the hatch.

Just a word about the placing of the thermometer in the incubator: It must be remembered that there is a difference in the egg chamber of the incubator of a degree for every half inch which the thermometer is raised or lowered. If it is raised half an inch, the temperature registers a degree higher; if it is lowered half an inch, the temperature registers a degree lower. This must be taken into consideration, and if a hanging thermometer is used, allowance must be made for the distance between the eggs and the thermometer and the machine be run at a correspondingly higher temperature. For instance, if the thermometer is one inch above the eggs, the machine should be run so that the thermometer registers 105 degrees, as the temperature on the eggs is really only 103 degrees. A thermometer on the level with the eggs should register 103 degrees.



Courtesy N. J. Agricultural Experiment Station

A battery of trapnests as built from the plan on page 145

Rye straw is a necessary element in housecleaning. Fresh litter and plenty of it adds to the cleanliness of a house (chapter XIX)

Plate XXVI. Early hatched pullets begin laying when the older birds are "laying off" (see chapter VII)

The successful incubator operator has learned most of his points by experience. To be sure, he must have had certain rules and principles which had to be followed, but it is only practice and intimate contact with the work itself that have made him proficient. Methods that one man uses will undoubtedly not appeal to another man, but, in general, the principles and methods given above are followed by most successful poultry keepers and have been found to be satisfactory.

CHAPTER XVI

PEDIGREEING THE CHICKS

PEDIGREEING implies, as a rule, that there is a trapnest record to show the hen's production. Trapnesting, then, may generally be considered the first step, hatching the eggs separately the second step, and the marking or otherwise identifying the chicks the third step in pedigreeing. Nevertheless, if you have done no trapnesting so far, you may still have use for pedigreeing. You may have a dozen or so hens in the flock that you know to be good. Why not hatch all the eggs possible from these good birds and breed their good characteristics and laying ability into the flock the following year by means of their sons? It can be done with very little work.

It is my opinion as well as the opinion of other poultrymen, that trapnesting is the only sure way of knowing how you stand as to a bird's actual production. Trapnesting for the whole year is the only accurate way of knowing a bird's production. It is not necessary to trap the whole flock; from a quarter to a third of the flock is a convenient number to handle.

Producers and Reproducers

Trapnesting and pedigree hatching enable one to tell not only what hens are good producers, but also what hens are good reproducers—in other words, what hens are able to produce strong, healthy chicks and pullets that will make creditable records during their laying year. A hen that is a producer of a large number of eggs from which will be produced a number of healthy chicks, and later from these chicks high-producing pullets and strong, vigorous cockerels, can easily be identified by the trapping and pedigreeing process and be retained as long as she lives as one of the best breeders. A hen that is a good layer but is unable to produce healthy progeny may be placed with the layers, on the other hand, rather than be retained in the breeding pen. I have not the slightest doubt but that one's season's hatches may be made to average as high as eighty-five or even ninety per cent., by removing birds from the breeding flock that continually lay infertile eggs or eggs that contain germs of such low vitality that they will last only one or two weeks in the incubator. A hen with a low production can easily be detected and discarded altogether. In addition to producing pullets from known ancestry, cockerels will also be obtained, and these males from mothers of good records can be mated to the remaining two thirds or three quarters of the flock that is not trapped—or whatever portion

is used as breeders—to improve the quality and production of the whole flock.

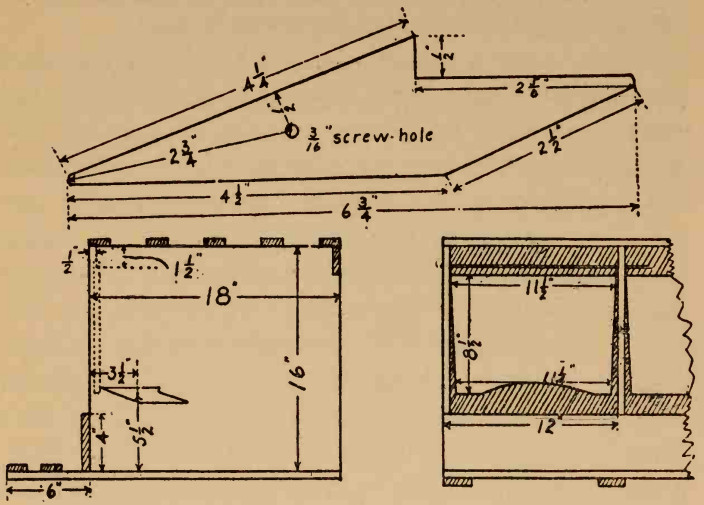
Pedigreeing adds the further advantage of bringing increased prices for stock and hatching eggs from these particular pens. Thousands of customers want pedigreed stock and are willing to pay for it, if they can have some sort of assurance that it *is* pedigreed. A man that does pedigreeing and trapnesting year after year does not have to give a guarantee. His birds do that for him.

The first step in this whole process is, as I have indicated, trapnesting. Of course, if you want to go way back to the beginning, I'd have to mention the selection of stock to be trapped, but I won't do that: it will take up too much space. Each bird must be legbanded to identify it, and the more plainly these bands can be read, the simpler the process of trapping is going to be. Some poultrymen put on the bands only as the birds begin to lay.

The next step is building the trapnests. There should be at least one nest for every three birds in the pen and it *must* work satisfactorily, that is, it must allow only one bird in the nest at a time and hold her until released by the attendant. If the nests do not work efficiently, the trapnesting amounts to nothing. The plan on page 145 gives some idea as to how the nest should be built.

After the birds have been banded and the nests

built, the next factor to consider is the process of trapnesting. During the heavy laying season, which is the natural breeding season—March,



Courtesy N. J. Agricultural Experiment Station.

Fig. 10. Trapnest of simple construction. Note the trigger, as this is the important part. The nest may be used for any breed of fowl.

April, and May—the trapnests should be visited every hour. The purpose of doing this so often is twofold: to release the hen from the nest as soon as possible and give her her freedom, and to get as many eggs as possible before the nests become full and the hens are compelled to lay on the floor. During the remainder of the year, the nests need not be visited so often, twice in the morning and twice in the afternoon being suf-

ficient—indeed once in the moring and once in the afternoon are enough at some seasons when the production is very low. This can easily be governed by the time of day at which most of the birds lay. It varies in different flocks.

When eggs are being saved for hatching, they should be marked as they are taken from the nest, marking the hen's number plainly on the large end. This is, of course, for identification for pedigreeing the chicks. After the eggs are put in the incubator, those from all the hens may all be kept together provided the eggs bear the numbers of the hens whose progeny are to be pedigreed—until the nineteenth day of incubation, at which time the incubators are closed for good until the hatch is over. It is at this time that the process commonly known as pedigreeing begins. While the eggs are being cooled for the last time before closing the incubator for good, they must be separated, all the eggs from each hen being kept by themselves.

Wire Hatching Baskets

In order to keep the eggs separate, one of two methods may be followed: they may be placed in small cheesecloth bags and the bags securely tied, or they may be placed in small wire baskets having lids that can be fastened. In using the former method the bags should be made of cheesecloth and should be about six inches wide and twelve

inches long, with the opening at the small end. Such a bag will not hold more than six eggs. The eggs are placed in this bag, together with a slip of paper on which is written the hen's number and the number of eggs placed in the bag, or the bag may be tagged on the outside, which is probably a better method. The bag is then tied

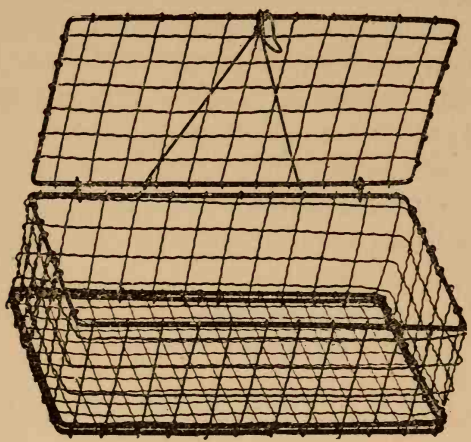


Fig. 11. Wire pedigree hatching basket used in pedigree hatching. This basket will hold six eggs.

tightly with a string or pinned with saftey pins near the end to give the chicks as much room as possible after hatching.

In using the other method, the eggs from each hen are merely placed in a wire basket of one-quarter or one-half inch mesh about 4″ x 8″ x 3″ and the lid fastened down. A corn popper

makes an excellent pedigree hatching basket. It is also a good plan here, too, to put a slip inside containing the hen's number and the number of eggs. Of the two methods, I think the latter is more efficient, because there is absolutely no chance of the chicks getting out of the basket if the lid is fastened securely, while with the bags the chicks find little difficulty in picking holes in them and thereby escaping; the chicks have more freedom to move around in the baskets; there is not so much chance of their smothering after hatching as in the bags; better hatches are likely to be obtained when the baskets are used as the material of the bags seems to absorb a great deal of heat that the eggs should get. The baskets will take up a great deal of room, however. Nevertheless, they are the more efficient in the end.

The final step is a mighty important one, namely, the banding or identifying of the chicks. There are two methods of doing this. One is by toe-punching all the chicks from one hen alike, the chicks from another hen alike, etc. For example, the chicks from one hen might be punched in the outside web of the left foot, those from another hen in the inside web of

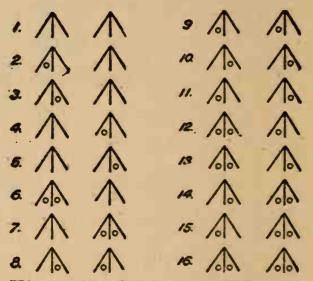


Fig. 12. Sixteen different methods in which chicks may be toe-punched.

the right foot, those from a third hen in both webs of the left foot, and so forth. There are sixteen possible combinations. Care must be taken not to cause bleeding. The other method is by legbanding with small open pigeon bands, which may be rolled to fit the small shanks. I think the latter method is more satisfactory. If this method is used, the bands must be loosened every two weeks and changed finally at eight or ten weeks of age to larger and more permanent bands. An easier way, however, is to take off the legband at three weeks of age and insert it in the tender flesh of the wing. This can be carried for life, but it is better to put on a legband in addition the following fall when trapping is to be begun. This is not painful to the chick. Whichever method is used, records *must* be kept. If they are not, this extra work has been for nothing. The hen's number must be set down and after it the band number of all her chicks or the toe punch combination. This is for identification later on.

This is one of the most interesting branches of poultry raising, especially as the results can be watched so closely because all the facts are known concerning the ancestry. Furthermore, it is the only practical method of building up a high-producing strain of birds. Even though a person has not been trapnesting since November first, he need not think he must wait until next year

before any pedigree hatching can be done, for he can select his good birds with a fair degree of accuracy by starting trapping immediately—good enough for a start until next fall. The chances are that the birds that are laying well in February are good birds, as are also those that lay more than twenty-five eggs apiece during March and the same in April. It pays. Try it.

CHAPTER XVII

MISTAKES MADE IN BROODING

It was just a small farm corporation I visited, composed of father and son. They had had a few years' experience in raising poultry on a larger scale than is found on the average general farm. The son, a big husky chap, attended to most of the farm work, while the father took entire charge of the chickens and helped out on the farm when he had a chance. They wintered over each year close to a thousand layers and breeders, in addition to caring for an eighty-six acre farm. As they had been successful with their poultry thus far, I was curious to know how they had made out last year. In response to my queries, I was told they "had made out fairly well, but could have done better had it not been for a few costly mistakes." "However," the head of the house assured me, "they will not happen again."

"Yes," said he, "we had twelve hundred fine-looking chicks at the beginning of the season and everything went along in great shape until they were about two weeks old. Then it seemed as if one thing after another was bound to happen.

When the causes of it all were sifted down, however, we found that we, ourselves, were to blame because we had either forgotten or neglected to look out for certain things."

All Kinds of Hard Luck

"It began by finding twelve chicks in one section of our brooder house torn and chewed to pieces."

"Rats?" I inquired.

"No, cats. You know, when cats get into a flock of chicks, they chew up as much of the meat as they can, leaving the head, wings, and legs. Rats, on the other hand, will pull off the head and sometimes the wings, leaving the rest of the carcass intact. Oh, I know, for we've had experience of both kinds, as I'll tell you later. But to go back to the cats. After I examined the chicks—or rather, what remained of them—I looked around to ascertain how the stray cats had entered the apartment. I always kept my door shut and locked, and, though I always opened windows for ventilation, I had inch mesh wire over them, so nothing could get in there. Then my glance happened to fall upon the small exit doors. There I had it: I had neglected to close these little doors the night before. There were only two things to be done: make sure to shut all doors at night and kill any stray cats I saw around the place, both of which I did.

"Rats were my next pests. I lost ten chicks one night and nine the next in one of my colony houses. To be sure, it was disappointing and disconcerting, to say the least, to find the casualties the first morning, but as I absolutely did not have the time to plug up rat-holes that day, I let it go at that and didn't do anything. But after the casualty list had just doubled the next day, I got busy. I 'sicced' the dog on them and as she was a good little ratter, we managed to root out and kill eight of the enemy. I set traps, but that didn't seem to help any, and I'm sure we didn't get them all. But you can bet I didn't lose any time, the first spare day I got, in raising my colony houses a foot off the ground. I put some old hollow tile under each corner. My floors are well built, so I'm sure they'll be warm enough this coming season, especially with the sand and litter on the floor. I also strung inch mesh wire around the house, sinking it in the ground ten inches."

He might also have bought some rat virus and sprinkled it around. This can be purchased from a New York concern and consists of cultures of a disease which affects rats and mice only, and will not injure any other kind of animal. It has been very successful in many cases.

"In one section of my long brooder house, the chicks began to look very poorly and I lost a number of them—I'm ashamed to tell you how many I really did lose. For a long time I couldn't

tell just what was the matter. I finally discovered that the milk I had been feeding had slopped over into the litter and had become moldy. The chicks had eaten this with disastrous results. I had had the milk pan just sitting on the floor. Of course I brushed away the litter from it, leaving it in a clear space. From then until the end of the season, the drinking pan was kept on the platform and its condition was carefully watched. You may be sure that after the horse is stolen, the door is locked. I used to kind of laugh at folks for this sanitation stuff they hand out. But I reckon the laugh was on me this time.

"A few mornings later, I had been out to tend the chicks before breakfast and, after having had breakfast, was going past the brooder house when I thought I would just take a peek in. It's well that I did. There I found the chicks piling into the mash hopper. Those on the bottom hadn't a chance in the world, for they were caught in the corners and between the sides and the wire grid. I was using these metal hoppers with a lip just inside the edge to prevent wasting the mash and a wire grid which lay right on the mash. The chicks had caught in a corner in which the metal lip had come loose and between the side and the wire grid. I took out nineteen dead. This year, I intend to use simple, homemade, wood hoppers two feet long, eight inches wide, and four inches deep, with a piece of lath around the top edges

to prevent wastage of mash. No more metal chick hoppers for me!

"When a hatch came off some three weeks later than the one with which we had so much trouble, I had no milk for the chicks, as we had made arrangements to sell all the milk produced on the farm—which wasn't a great deal, anyway. I was sorry afterwards that we had done it. The chicks consequently had no milk to start on. And they showed it, too, inside of a couple of weeks. Never again will I start to brood chicks without milk. I didn't know right then of the milk powder or semi-solid buttermilk. But after about two weeks of this sort of business, I found out from a fellow in a neighboring town of the buttermilk powder and semi-solid buttermilk. I tried some of each with very good results. The chicks began to pick up and I'm sure it's the only thing that saved them. If I can't get regular sour milk another time, I'll use either of these products again.

"With my older chicks I was also having trouble: they didn't look right. After much thinking and worrying and wondering, I finally concluded that the slow, poor development was due to lack of green food. I had neglected to seed down the chick runs in the fall, in spite of the fact that my wife had been after me to do so. The result was bare yards and poor chicks. I immediately let them out into a small alfalfa field

I have, and say, you should have seen them grow! Yes, I learned my lesson here just as I did with the milk. Milk and green food are absolutely essential, I believe. This last fall, I seeded down my runs for the small chicks to rye, so that they will have something to start on the first thing in the spring. The rest of my chicken land—ranges and yards of my laying houses as far as possible —I seeded down to alfalfa. I believe alfalfa will work wonders with layers as well as with growing stock."

A Good System to Follow

My friend had indeed had one thing after another, but has come through better than a good many, for the reason that he knew where he had made his mistakes and knew what to do to correct them. In order that others may not make similar mistakes, I am going to outline, briefly, a good system of caring for baby chicks. I do not claim that this is the best system, for other systems are used which give good results. I do know that it is a good system, however. The underlying principles in caring for chicks are the same, and I'm sure that others who may use different systems will agree with me in this.

Probably the first topic which comes up for consideration in caring for baby chicks is the feeding question. This is because so many mistakes are usually made right here, especially at the start.

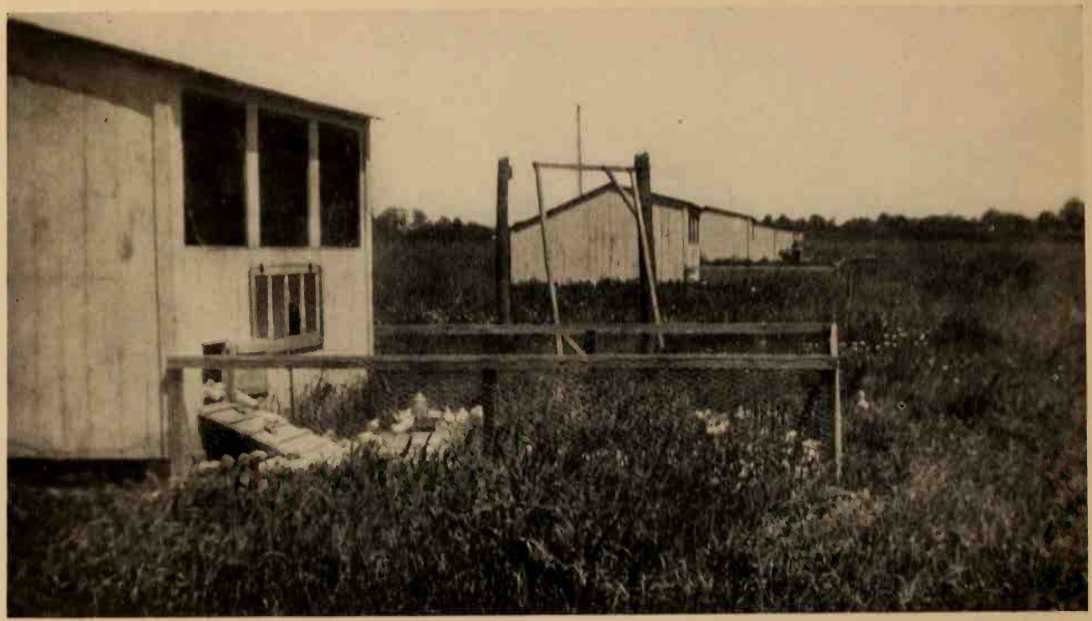


Plate XXVII. The first yard for the chicks. They must be trained in this manner until they learn how to get back into the house

A chick doesn't need to eat the very first thing he does, in spite of the fact that he is always picking at something. Just before the chick is hatched, the yolk is drawn into his body, and it is here that he carries an equivalent for his first few meals—his canned ration or condensed food, or what ever you will. This food lasts him for thirty-six to forty-eight hours, and is just exactly what he needs to get things started right: it acts as a laxative and supplies first nourishment. During this time, he may be given sour skim milk or buttermilk or semi-solid buttermilk diluted with water. This can be kept before him in a low drinking pan, so that he can help himself. Fine chick grit, too, should be plentifully in evidence.

The first food should be given the day after the chicks are put in the brooder and may consist of a grain ration composed of equal parts of fine cracked corn, cracked wheat, and steel cut or pinhead oats. Some feed rolled oats for a few feedings, as they are bright and easily seen in the litter by the chicks. They are easily digestible, also, when not fed in large quantities, but when too much of this material is fed, it becomes sticky and serves to "paste up" the chicks. The grain mixture, as suggested above, should be fed five times a day for the first week: early morning, middle of morning, noon, middle of afternoon, and late afternoon. Especially should attention be given to the late afternoon and early morning

feedings. The long night which intervenes is a long stretch for the youngsters, so the last feeding at night should be as late as possible before dark—just so the little fellows can have time to fill their crops before going to bed—and should be as early in the morning as possible, so they will not be without food longer than is necessary. The night feeding should be generous, too, to provide something for the early risers to pick at before the owner gets out to them. At each feeding, only such an amount should be given as can be cleaned up by the chicks in about fifteen minutes. Since chicks have such small digestive systems, they cannot be fed in large amounts—overfeeding will result in digestive disorders and bowel trouble. It should be the purpose of the poultry keeper to fill the chicks' crops as soon as they are empty and to keep the chicks continually growing. This is done by wise feeding: feeding often and in small amounts.

At the end of the first week, wheat bran in open hoppers may be put before the chicks for a couple of hours at a time for two or three days—preferably in the middle of the day. When this is done, the noon feeding of scratch may be omitted. After two or three days of this, the bran can be kept before the chicks all day until the end of the second week, at which time the bran is replaced by dry mash. The purpose of keeping the bran before the chicks for a little while the first two or

three times is to prevent the youngsters from "stuffing" themselves on this. It is very often the case that when something new is put in the brooder pen in the way of feed, chicks will like it so well they will stand by it and "stuff" until they are so full they can hardly walk. This is true not only of mash or bran, but also, sometimes, of water and milk. Where such a habit has been formed, keep the pan or hopper as the case may be, before them for short periods, removing and replacing later. Succulence may be given at the end of the first week in the form of sprouted oats, lettuce leaves, cut cabbage, or other green food.

The dry mash referred to above which should replace the bran may be composed of

3 parts wheat bran
1 part wheat middlings
1 part ground oats
I part corn meal
I part buttermilk powder
½ part meat scrap

From now on, the scratch ration need be fed only three times daily: morning, noon, and at night. Where buttermilk, or sour skim milk is fed as a beverage, i. e., in pans kept before them all the time, it can be omitted from the dry mash ration. The amount of meat scrap in the mash ration should be increased gradually, week by week, so that by the end of the sixth week there is one part

of meat scrap in the ration instead of only one-half part. This method of feeding—dry mash before them all the time and scratch fed three times a day—can be maintained until the eighth or ninth week, at which time the young stock are ready to leave the brooders and go on range (depending upon season and weather conditions, of course). Grit should be readily accessible to the growing chicks at all times.

When the youngsters are put on range, the above dry mash may be kept before them and the grain feeding changed to equal parts of cracked corn and whole wheat, fed twice daily, morning and night. Green food must be in abundance. Fresh water and protection from the hot rays of the summer's sun are also essential.

How Hot Should the Brooder Be?

Heat is an essential element in brooding chicks. Too much is as disastrous as too little, and for this reason great care should be given to the temperature of the brooder. For anyone who has brooded a number of chicks it is a comparatively easy matter to judge the proper temperature merely by placing the hand under the hover and feeling the degrees of heat in this way. True, this is not an accurate measurement, but does well for experts. For those of us, however, who are not so expert in judging the temperature in this manner, it is best to have a thermometer hanging

from the hover just inside the outer edge. This is only half of it. The other half is to have a temperature schedule or scale to follow. Such a scale as this works very well:

First week	100°–98°
Second week	96°–94°
Third week	92°–90°
Fourth week	88°–85°

The idea, of course, is to start the chicks fresh from the incubators at a temperature slightly less than that at which they were hatched, and lower the temperature gradually each week. The speed at which the temperature may be cut depends very largely upon the season in which the chicks are being brooded. If they are early hatched chicks, hatched in February or earlier, the temperature must be reduced more slowly than if they are hatched in March or April. It is a good plan for a person to accustom himself to estimate the temperature without the use of a thermometer. The above schedule is given merely as a guide for beginners.

After the fourth week, the temperature may be reduced fairly rapidly until the heat may be done away with entirely (provided the season admits of it). At this time, however, they should be watched closely as an occasional cool night may take a big toll of chicks unless heat is provided. Materials should always be at hand, then, to build a fire if needed, that is, if a coal stove is

used; or the lamp should be filled and ready if an oil brooder is used. After heat has been discontinued the hover should still be lowered for a few nights or a week, after which time it may ordinarily be removed for good. As I said before, the speed with which this weaning process is carried out depends very largely upon the season and upon individual circumstances as well.

By all means maintain such a temperature at all times that the chicks will not crowd. Crowding is nearly always the result of a low temperature: they crowd and huddle together to keep warm. As soon as the first signs of crowding are noticed, the heat supply should be looked to immediately. True, crowding often occurs even when the temperature under the hover is correct; such a condition is likely to exist, especially at night, when the chicks don't know where to go after dark. Chicks will also crowd sometimes in the corners of the brooder house, apparently from habit. By chasing them under the hover and encircling the hover with a fence of inch mesh or three-quarter-inch mesh wire about a foot and a half to two feet high, the chicks will soon be taught where they are to go at night. They may be kept out of the corners by tacking a small piece of poultry wire across the corners. Indeed, as far as encircling the hover with wire is concerned, this should be done, anyhow, as soon as the chicks are put under the hover, and the wire

should be kept there for the first couple of days the chicks are there, and should be put up every night for at least two weeks. *Close watch is required at all times.*

Toe Picking

One of the worst habits which chicks develop is the habit of toe picking. This may develop in the early days of brooding, due to having too many chicks in one compartment or to having too limited a run for them. It starts innocently enough: the chick sees this little bright object on the ground before him and picks at it. It turns out to be some other fellow's toe. Others are attracted by the same thing and before long, the skin has been broken and the unlucky one of the picked toe is bleeding. The best thing to do is to remove any that have been picked and are bleeding and keep them by themselves until the wound is healed. If it is impossible to keep them by themselves, some bitter aloes may be rubbed on their feet and the chicks put back in the pen. The rest of the chicks in the pen should also be treated with aloes in the same way. Toe picking may also start in the incubator if the chicks are left there too long before transferring to the brooder.

If toe picking is allowed to go on in a flock, it may develop into cannibalism—a most disgusting and disheartening condition. After the taste for

blood has once been acquired through toe picking, the chicks seek elsewhere for blood, picking at the vent until blood is drawn. In advanced stages of this disease or habit, the very entrails are eaten out of the chick. It is very hard to stamp it out of a flock once it gets in. Cannibalism is more easily acquired in a flock where the amount of meat scrap or meat products fed is small. If such a condition exists, all chicks that have been picked ought to be removed and kept by themselves. Meat scrap can be left around in open hoppers for a few days and a dry mash composed of equal parts of meat scrap, dried bone, oyster shell, and wheat bran may be given for a week or so in addition to the regular mash. In addition, plenty of green food will help bring them around into good condition. A large yard covered with some growing crop is one of the best antidotes to this trouble. It may also serve, in some degree, as a preventative.

Their First Airing

Too many poultry keepers in brooding chicks seem to think that the youngsters ought to be kept shut in until they are several weeks old—especially the early hatched chicks. It is a mistake, nevertheless, to do this. Chicks should be allowed to go outside just as soon as possible—any time after the first week; indeed, there are some who even advocate letting them out the third day

Plate XXVIII. One method of watering the range where running water is not present. Note that water barrel is placed in the shade

after placing them in the brooder. Allowing the youngsters to run out early, even though there is snow on the ground, helps to strengthen them. When there is snow outside, a small space may be cleared away to allow the chicks to get out. After they have gotten the idea of going out, it is not so necessary to keep a cleared space, as it won't hurt them at all to run on the snow. Leg weakness is often laid at the door of walking on the cold ground, but as a matter of fact, I have seen and heard of more cases of leg weakness due to too close confinement in a heated room than to allowing the chicks to run outside early. Indeed, this is one of the ways of treating leg weakness: let the chicks out. Incidently, another cure for leg weakness is to give baking soda (sodium bicarbonate) in the drinking water. This is given at the rate of three tablespoonfuls to sixteen quarts of water, and is kept before them with nothing else to drink for three consecutive days. This treatment is repeated in two weeks. It is a very good plan to give this soda, every two weeks, beginning at the time the chicks are two weeks old and lasting until they are about ten weeks old, whether they have leg weakness or not. It seems to correct the slightly acid stomach that chicks quite frequently have.

Too many brooder houses are kept very warm and no arrangements are made for ventilation. When open-front colony houses are used in brood-

ing, the muslin curtains should be kept closed during the first week until the chicks have gotten a good start, after which time they may be kept open all the time during the day. They should be closed at night, of course, for some time, until the weather gets real warm and the chicks get bigger. Plenty of fresh air won't hurt the babies at all, provided they are not subjected to drafts.

Milk in the Ration

Undoubtedly one of the greatest factors in the successful brooding and rearing of chicks is milk in some form or other. Dr. McCollum, of Johns Hopkins University, tells us that milk is necessary for the proper growth and development of all young animals, that milk contains certain elements possessed by no other product, which appear to meet the needs of the growing animal. This being the case, it is absolutely essential that some form of milk—sweet milk, sour milk, buttermilk—be given to the chicks right at the start and kept before them for at least eight weeks, and if possible, until they are placed on range. The example, cited earlier in this chapter, of the farmer who neglected to start his chicks off with milk and who brought them back, even though slowly, with milk, is merely one incident of many that might be cited. It should be taken as a warning to all who intend to brood chicks this year: profit by

someone's else mistakes rather than make them yourself.

Besides the fact that milk, especially sour milk, serves to supply much-needed body food, the lactic acid it contains serves to keep the body in tiptop condition, and helps to keep away the much-dreaded bacillary white diarrhea. Some poultrymen are so anxious to get the sour milk into the chicks at the very start, that they cram it into each chick by means of a medicine dropper, making sure that the crop is filled with it when removing the chicks from the incubators. They make sure in this way that the chicks get this as their first food and are thus started right.

If it is impossible to obtain sour skim milk, as it very often is, excellent substitutes may be found in the form of buttermilk, any of the milk powders, or semi-solid buttermilk. The buttermilk may be given in drinking pans just as the sour milk is given, while the milk powders may be fed as suggested above in the dry mash. The semi-solid buttermilk, a material about the consistency of thick paste, is to be diluted in the water and served in the drinking pans as sour milk is given. It is generally diluted about one to seven, and is generally given in this form to chicks up to six or eight weeks of age, after which time it may be fed just as it comes—in paste form. A slab of it may be placed on a piece of wood near the water pan, so that the youngsters can pick at it and then

take a drink of water. Excellent results have been obtained with all the substitutes mentioned for sour milk. I would rather feed the sour skim milk itself, however, if I could get it.

The points I have mentioned are typical of what may be run into during a brooding season; there are countless others which I might have mentioned; there are numbers which cannot be foreseen, different problems arising on different farms. However, one general rule may be made to apply to all farms and conditions; namely, profit by the mistakes someone else has made. The experience of the farmer related at the beginning of this chapter is an actual experience of a man during a recent brooding season. Such things are apt to happen on any farm. Watch for them, be prepared for them, and *don't let them happen* on your farm.

Courtesy N. J. Agricultural Experiment Station

Plate XXIX. One way to provide shade and green food for the birds that are hatched a little late in the season

CHAPTER XVIII

GOOD HEALTH IN THE POULTRY YARD

"A STITCH in time saves nine," is an old adage which is known by everyone. Nowhere is this more applicable than in the poultry yard, yet hundreds of poultry keepers each year lose a large number of birds and seriously impair the health of the remainder of their flocks by not remedying certain conditions until too late. Many a poultry keeper, be he keeper of a back-yard flock, of a flock on a large estate, of a farm flock, or of a large commercial flock, has learned through experience to remedy unsanitary conditions as soon as observed—indeed, to prevent unsanitary conditions from existing in the first place. Sanitation is one of the main requirements in the raising of chickens and cannot easily be neglected with safety by poultry keepers who desire to make a success of this great chicken game and who enjoy the sight of healthy, vigorous, well-kept birds.

To begin at the place where sanitation is most necessary and where disease and vermin are most easily contracted and spread, let us turn our at-

tention to the house and yards. We all know that for chickens to do their best they must have a sufficiently roomy house that is dry and free from drafts, that allows proper ventilation and a large amount of sunlight; yet in spite of our very honest efforts, sometimes things go wrong because we do not work along the right lines. The few practical suggestions which follow have been tried time and again and have been found to be very satisfactory by those who have adopted them.

Four square feet of floor space for each bird should be allowed for Leghorns, while the heavier breeds, such as Plymouth Rocks, Wyandottes, and Rhode Island Reds, require five square feet of floor space for each bird. Thus, a house ten by twelve feet could accommodate thirty Leghorns or twenty-four Plymouth Rocks, while a house twenty by twenty feet could accommodate one hundred Leghorns or eighty Plymouth Rocks. It is not advisable to put more than the number recommended in a house, for conditions are then created which make the birds more susceptible to disease as a result of crowding and lowering of vitality, with the result that birds are not able to ward off an attack of disease. Conditions are also created which are admirable for the spread of disease.

A Damp House Will Cause Colds

A house may easily be kept dry by means of a cement floor, under which has been packed ten to

twelve inches of coarse cinders. This prevents the water which may seep in under the floor from remaining at the surface, as the cinders will cause the water to drain off, thus keeping the floor dry. Another advantage of having the cinders is that the danger of freezing and heaving of the floor is done away with, since the water is not given a chance to remain just beneath the floor. Ditches may also be dug around the house, to carry the water off to the lowest point away from the house. A damp house will cause colds and will so weaken the vitality of the birds that other diseases, such as roup and canker, will soon follow. With a litter of eight to ten inches in depth, this makes a very good floor for chicken houses. A board floor is excellent also, especially where the surrounding ground is apt to be damp. In such a case, the house should be raised slightly and a board floor is a necessity.

Other Essentials of Health

Birds need an abundance of fresh air. A peek into a house that is close and stuffy, with very little or no ventilation, will satisfy one as to which condition is better. Where very little ventilation is provided and the laying house is kept too close, the birds are subject to colds as much as are birds in a damp house, for they become so tender that they cannot withstand severe winter weather. Ventilation must be provided to purify

the air in the house and remove the fumes arising from the birds' bodies. Proper conditions as to fresh air and ventilation may be obtained by means of a muslin-curtained window in the front of the house, leaving the window wide open at all times, except in very rainy or severely cold weather, when the muslin curtain may be lowered. To prevent drafts have perches in the rear of the house, making sure that all cracks and crevices are filled in. If the house is a long one, partitions should be built every twenty feet to prevent drafts on the perches.

Sunlight is the best disinfectant and purifier we have. It is, therefore, to the advantage of the poultry keeper to admit all the sunshine possible to the chicken house. Have the windows so arranged in the front of the house that the sun will touch every part of the floor sometime during the day. This will kill germs that are present on the floor or in the litter, and in addition will create an environment that is healthful and pleasant for the birds. Birds will do much better in a light and airy house than in a dark and stuffy one, and the poultryman's trouble to create these pleasant conditions will be amply repaid by the good health of his flock and the profit they will net him.

If it is possible to do so, allow the birds free range; they will keep healthier and there will be less danger of disease spreading should one

Courtesy of the Country Gentleman

Flocks in small houses do better than in large units, owing to the better attention they may receive. The labor is the main item here, however (see chapter V)

Plate XXX. The way to keep yards and ranges sanitary is to keep something growing there (see chapter XVII)

or two birds become affected, as conditions are not so congested as when the birds are kept in yards. However, it may be necessary to confine the birds for one reason or another. When this is the case, not more than 400 birds should be kept to the acre—about 100 to 150 square feet to the bird. Make an effort to keep some sort of permanent sod in the yard—keep something green growing there at all times. If this is not done, the ground becomes bare and contaminated by the droppings. Where it is impossible to plant green stuff, plow the soil under frequently and lime it occasionally. The danger from contamination by droppings can readily be seen in attempts to raise chicks year after year on the same ground without a rotation of crops providing some sort of green food; chicks will stand around, droop their wings, lose their appetites, and finally die. Older birds are affected to some extent in the same way. Sanitary conditions should prevail here by all means, and every effort should be made to keep things clean and fresh and to avoid contamination.

Just as disease gains entrance to a man's body through things he eats, so with poultry: Numerous bacterial diseases are admitted to the body through the alimentary tract in feed which is given the birds or in things they pick up on range. First, then, make sure that all feed is absolutely clean and free from foreign matter. If any feed

looks suspicious, don't feed it; send a sample to the nearest experiment station for analysis. If it is pronounced all right, then feed it. Prepared dry mash, as well as certain grades of meat scrap, is apt to sour.

Another cause of trouble often overlooked by poultry keepers is moldly straw for litter. Not only does this contain dust which irritates the bronchial tubes, but it also contains spores of certain bacterial diseases. Avoid using old or moldy straw for litter, as it is likely to be dangerous.

Particular care must be taken in the method used in feeding the stock and in the cleanliness of the feeding and drinking utensils. All utensils should be scrubbed thoroughly at least three times a week. If this is not done, in the case of wet-mash feeding especially, feed is apt to be sour, resulting in digestive disorders in the birds. As birds meet frequently around the drinking pan or fountain—oftener probably than round the feed trough—there is more danger of the spread of disease here than elsewhere. Water is an ideal substance in which disease can be spread, and it must therefore be changed daily and the pan washed thoroughly and disinfected every other week with some good disinfectant. It is a good plan after washing the drinking fountain, to allow it to dry in the sun; this will kill all germs.

Change the Feeding Place

When feeding the grain ration in the yard, change the place of feeding frequently. If the birds are fed in one place every day, the ground will become bare and contaminated by the birds' droppings. This makes an ideal place for the spread of infection. When feeding in the yard, examine the whole yard occasionally and pick up any carcasses of chickens or other animals which may be lying around; if these are allowed to stay in the yard, they decay and are eaten by the birds, with the result that the flock becomes affected with ptomaine poisoning. This is more likely to occur in warm weather, but may happen at any time. It is best to prevent such losses from this cause, however. Any carcasses thus found should either be burned or buried deeply.

The scratch ration when fed in the house should not be dumped in a heap, but scattered round in deep litter. This is to make the birds exercise. Exercise is essential to the health of the birds, as it is this which keeps them in good condition, permitting the various organs of the body to carry on their normal functions. Don't allow the birds to overfeed.

Other Precautions

Never breed from any stock that has at any time been sick, for the offspring are apt to be sub-

ject to the same diseases the parents had. While the disease may not be hereditary, still there will always be that weakness among the young stock that will make them susceptible to the disease. By breeding from diseased birds or low-vitality birds the poultryman will always have a flock of low-vitality birds, subject to any disease that appears. He will have a most discouraging proposition on his hands, against which all the sanitary methods he may use will not avail.

When a sick bird is noticed, remove it from the rest of the flock immediately and keep it isolated for several days. If the trouble seems to be a simple one and not of a severe nature, the bird may be treated, if desired, and upon recovery, returned to the flock, after having been legbanded with a celluloid legband to show that it has been sick. Never breed from this bird. The question of whether or not a bird should be treated for any disease is a personal question to be settled by the individual poultryman himself; personally I would not care to treat a bird for anything else than a simple eye cold—for anything else, use the axe.

Any new stock that is brought on the place should be isolated for about two weeks to see that no contagious disease appears. If the stock is all right turn them loose with the flock.

CHAPTER XIX

FALL HOUSE-CLEANING IN THE POULTRY YARD

JUST at the fall of the year, when the poultry keeper is ready to begin a new year, when the old birds are about to be disposed of and the new birds or pullets placed in the laying houses for their first year's work, the poultryman turns over a clean page in his account book and is ready for whatever the year may bring forth. Why not also start the poultry year with a clean house and yard?

The value of giving the houses and yards a thorough cleaning was explained by an experienced poultryman with whom I talked recently.

"I find it almost a necessity to start my pullets off in the fall in clean, wholesome surroundings," he said. "I plan to give my chicken houses and yards a thorough cleaning at least twice a year—in the fall and spring—but especially in the fall; I never miss cleaning in the fall, although I do occasionally in the spring, owing to the rush of work. I consider the fall cleaning very important, for, aside from the fact that there may be traces of disease and vermin from the

previous season's birds, I like to see my pullets, that I've spent the whole rearing season to bring to maturity, go into a clean building and to know that they are given a good start."

I asked him just how he went about his house-cleaning.

"Well," he said, "I generally remove everything that can be moved in the house, taking all these movable parts out in the sun. Perhaps I should have told you that I choose a bright, sunny day for my cleaning process. I then brush all these parts, such as perches, nests, hoppers and drinking fountains or pans, and scrub them with warm water and soap. This process is followed by a thorough spraying, after which they are left to dry in the sun until the house is ready for them."

Use Plenty of Spray

In reply to my inquiry concerning the materials he used as sprays, he replied that nearly all the commercial preparations gave satisfactory results and could be relied upon. A spray that gave excellent results was one which was a whitewash mixture with disinfectant in it.

"After all the fixtures are taken care of, I remove the old litter and sweep out the house, 'for further orders,' brushing down cobwebs and getting into corners, cracks, and crevices. Next I supply a liberal dose of disinfectant, using a fine

mist spray and getting into every place that could possibly harbor vermin. It doesn't cost anything to be too careful and sometimes saves a big loss later on. If for any reason I cannot obtain a commercial disinfectant, I use kerosene on the droppings boards and roosts and give the house a coat of whitewash.

"The house is then given a chance to dry out and air thoroughly, after which clean, fresh litter is put on the floor to a depth of ten inches or a foot. I generally use rye straw, because I have lots of that on hand. I believe rye and wheat straw make the best litter. The fixtures are then replaced and everything is in readiness for the birds."

I asked if his cleaning stopped there.

"Not a bit of it," he said. "It extends to the yards also. You may think my yards look clean, but as a matter of fact, I do not consider them clean till I have plowed them up and sown some crop to supply green feed and a scratching place for the birds in the spring. Wheat or rye do very well, giving a luxuriant growth and arriving at about the proper stage for the birds in the spring.

"I am very particular to have all my fences in good repair at this season, because the pullets just coming in from the range are very wild and will get over or through anything if they are given half a chance. Then, too, if the fences are fixed now, a great deal of labor will be saved in the

spring, although, to be sure, holes are apt to be opened through weak spots during the winter, due to the severe weather. However, if the fences are fixed properly in the fall much time will be saved in the busy season."

Clean the Flock Too

Let the house-cleaning not rest with the cleaning of the house and yards, but let it also extend to the birds. Have a house-cleaning of the birds, in which the flock is cleaned of undesirable and unprofitable fowls. Keep as the old layers or breeders only the birds that are healthy or have been healthy and vigorous throughout the year. Any bird that has been sick during the past season is likely to be sick again and will prove very unsatisfactory as a breeder. Only those birds that show evidences of high vitality, such as erect carriage, bright eye, and bright, healthy-looking comb, should be retained as breeders. If weak, sickly hens are used as breeders, low fertility in hatching eggs may result and the eggs that do hatch will result in weak and scrawny-looking chicks. The room taken up by these unprofitable hens may very easily be used to good advantage by the pullets. So don't sacrifice probable profits from the pullets for the impossible profits from worn-out or unhealthy hens.

The fall cleaning may very well be extended to the new birds or pullets, weeding out all the

poor-appearing ones—that is, those that do not give the appearance of high vitality, health, and capacity for production. A pullet that is small proportioned, having narrow body and small proportions in her "laying regions," as well as a pullet that is all neck and legs—in other words, a pullet having an awkward appearance—is very seldom a good and persistent layer.

Now is the time to continue the good work of cleaning and delouse the pullets as they are placed in the laying house. This is best and most easily done by using a powder known as sodium fluoride. Each bird must be handled separately: a pinch of the material is rubbed into the feathers around the vent, a pinch on the thigh, a pinch on the breast, a pinch under each wing, a pinch on each wing, a pinch on the head, a pinch on the neck, and a pinch on the tail.

There is another phase of poultry-house-cleaning which should receive some attention, and that is the cleaning of the feed room. A poultryman should, if he is able to, lay in as much of his yearly supply of feed as he is permitted to get; it will save him money, as feed is cheaper in the fall than it is during the rest of the year, and it will save him some anxiety.

CHAPTER XX

THE FARM POCKETBOOK: EXPECTED COSTS AND RETURNS

Probably we all are too prone to "count our chickens before they are hatched," but we must, at some time during our poultry year, take out our pencils and paper and do some figuring, so that we may know about what we can expect and how we are going to come out. It is necessary so that we may make our plans for the following year in advance—a good poultryman doesn't plan his work and his "crops" from day to day: he plans his work and his "crops" a year in advance. We should know, therefore, how to go about figuring our probable costs and returns.

Expected Costs

Let us first consider some of the items that go into the poultryman's ledger as expenses. They may be grouped under a very few heads, but the largest one of these is the feed cost. Others are interest on investment, insurance, taxes, labor, depreciation, supplies, and miscellaneous expenses. It is always a difficult matter to set exact

figures upon various items of expense, as conditions on the various farms and prices received for products, as well as prices paid for commodities, differ in various localities. There is only one item in the cost list that I am going to attempt to set a figure on and that is the feed cost. I may say right here that all the figures I shall give in this chapter are conservative, as I am not attempting to paint a bright and rosy picture of the poultry game, in order to mislead some poor sucker with very little money and no experience into entering the poultry business. The poultry business is like any other: a good thing to keep out of unless you know a great deal about it and have had some experience and some money to back you, or unless you have lots of money to keep you while you are learning. As a sideline which may be worked up in conjunction with some main line of endeavor, it is ideal.

With these few things in mind, then, let us proceed. A hen will consume an average of eighty pounds of feed in a year at an average cost—at present prices—of $2.25. This is for a bird of the light weight breeds, such as the Leghorns; a heavier bird will consume about ten pounds more of feed a year at a slightly higher cost. Feed is much more reasonable now than it was a year or two ago, and the cost of keeping a bird is much less than it was, therefore. The other items given above as making up the poultry keeper's expense

sheet will total in the neighborhood of $1.50 per bird. It is safe to use this as a figure, although in many cases it is too high.

Expected Returns

Bearing these figures in mind, let us turn our attention to the expected returns and to the method we follow in arriving at them. To do this, I am going to assume that we have a flock of 100 Leghorns. They are only mediocre birds, averaging 120 eggs apiece for the year—10 dozen eggs each. I am using this figure because any Leghorns that are worth anything at all ought to lay this many eggs; in fact, we have a right to expect this many eggs. Further, I am giving a table below to show about how this production may be expected in the various months:

Month	Production per Bird	Month	Production per Bird
November	4	May	16
December	6	June	14
January	7	July	13
February	10	August	12
March	14	September	9
April	15	October	5
		Total	125

This production totals up to 125, but let us still use our figure of 120.

Very well, we have a total of 12,000 eggs to dispose of during the year. Are we to go out and

sell all those eggs? If we do, what shall we do for the replacement of our flock for the following year? We must, therefore, make some arrangements for replacing the poor birds that we cull out, and plan to add some to our flock. Suppose we plan to keep 100 breeders and 100 layers; in other words, we are doubling our flock. By selecting 50 of the old birds to keep over and by selecting 50 of our early hatched pullets (January or February hatched), this will make it necessary for us to produce 150 new females.

If the placing of 150 eggs in an incubator were all that was necessary to get 150 pullets, it would be easy. However, as matters stand, we must allow at least five eggs for each pullet we want to get, and those five eggs are divided up as follows: Of all eggs set, we must figure that—

10 per cent. are infertile.

60 per cent. of the remainder hatch.

20 per cent. of the chicks that hatch die.

50 per cent. of those that live are males.

With this in mind, then, we must set at least 750 eggs to get our 150 females. However, if we set an additional 250 eggs, this will allow us to sell 50 pullets ready-to-lay in the fall and will give us about 40 cockerels to sell as breeders, besides providing ourselves with males for the next season. There is good money and ready sale for full grown pullets in the fall as well as for cockerels—especially if they are from a high produc-

ing strain. We will set, then, 1,000 eggs for ourselves.

By referring to our table of expected production for the months of January, February, March, and April—the months in which we would save eggs for hatching—we find that we may expect a total of 46 eggs per bird during this period, or 4,600 eggs for all the birds. By deducting 1,000 for ourselves, we can sell at least 1,000 hatching eggs. We could probably sell more, but rather than figure on too high an income, we'll just figure on the 1,000. This leaves 10,000 eggs to sell as table eggs—let's call it 800 dozen. The hatching eggs are worth easily ten cents apiece and the market eggs ought to average fifty cents a dozen for the year. This may be a trifle high, although the average for the past few years has been considerably higher than this. Eggs may drop some below this figure, but I think for the present we are justified in using this figure.

Other "Crops"

Eggs are not the only source of income on a poultry plant by any means. What about all the surplus male chicks that are present in every hatch? By figuring that ten per cent. of all the eggs we set are infertile and sixty per cent. hatch of the remainder, we have a hatch of 540 chicks. Of this number probably twenty per cent. will die, leaving 432 head of young stock, half of which

are pullets and half cockerels, or 216 of each. Let's figure on 200 of each to be conservative. We can therefore figure on about 150 surplus males, which can be sold at broiler age for an average of about 75 cents apiece at the age when they will weight 1½ pounds. We can save ten cockerels for ourselves to use the next season together with the best of the old males, and can sell forty males as breeders at not less than $3.00; if they are any good, they ought to bring $5.00. Our extra fifty pullets we figured on selling at ready-to-lay age ought to bring us $2.50 a bird. The total expense for raising these birds to maturity, both pullets and cockerels, can be figured at one dollar per bird; this includes the cost of the egg, cost of incubation, cost of feed from time of hatching to maturity, and labor cost.

This is not all. We have mentioned keeping only 50 of the best of the old birds as breeders for next year, we must, therefore, cull out the poorest of the old birds and we can count on a cash sale here in the form of old fowl. It is necessary first, however, to allow for a ten per cent. mortality during the year. Allowing for this, then, we shall have about forty old fowls to sell. At 30 cents a pound, and each bird averaging three pounds apiece, we ought to net $36.00.

Another product which is quite frequently overlooked, but which deserves attention, is the manure. This is high in nitrogen and is an excel-

lent manure for gardeners, especially, although many general farmers can use it to advantage. It is worth considerably more than can be obtained for it in many places, and may easily be figured at $10 per ton. Each bird will void 60 pounds of collectible droppings in the course of a year. Just to be contrary, we'll figure it at 50 pounds. For 90 birds (allowing for ten per cent. mortality) at 50 pounds per bird, this makes 4,500 pounds, or 2¼ tons—we'll figure 2 tons at $10, or $20.00. Miscellaneous sales, if any, may be added, such as the sale of feathers (possibly), small fruits, vegetables, or anything else.

A summary of our receipts and expenses may be made as follows:

Receipts				Expenses
1000 Hatching eggs	@	$ .10	$100.	
800 Dozen market eggs	@	.50	400.	
150 Broilers	@	.75	112.	
40 Cockerels as breeders	@	3.00	120.	
50 Pullets	@	2.50	125.	
120 Lbs. fowl	@	.30	36.	
2 Tons manure	@	10.00	20.	
Total			$913.	
Feed for 100 hens	@	2.25		$225.
Feed for 250 young stock	@	1.00		250.
Other expenses 100 hens	@	1.50		150.
Total				$625.
Balance or profit			$288.	

In computing the above figures, I may possibly have been too high on some and too low on others. The final result will probably average up the same, no matter what figures, within reason, are used. The idea is not so much that the above figures are absolutely accurate, though I have tried to make them so, being as conservative as possible, using the best prices I had available; the main idea is to show how one should go about planning his sales and expenses, never forgetting that he must provide for replacing a portion of his flock and increasing his flock, if desired, and the means of doing this. Such figuring is necessary in the development of any poultry farm, especially if one is to rely on the sale of breeding stock for any portion of his income. The wielding of the pencil should not be allowed to become an indoor sport, however, but must be backed up by careful thinking and planning and *hard work outside with the birds.*

CHAPTER XXI

GETTING A POULTRY EDUCATION AND A START

It may be advisable to mention right at the start that this chapter is devoted almost entirely to the out-and-out city man, who knows nothing about poultry at all, and to the suburbanite, who knows a little about poultry but would like to know more, and how to get that knowledge.

Poultry raising seems to appeal to the city man who has had the "back to the farm" bug or who has read about three dollars a year per bird profit and has visions of wealth and luxury from a five thousand bird plant. Perhaps, also, it appeals to him because the work is not heavy and because he has to pay high prices for his eggs, and he thinks of the pleasure of taking in pail after pail of eggs at those high prices. The suburbanite who has had some experience with a small back-lot flock has enjoyed it so much and has probably had a profitable flock, so that he wants to go into it on a larger scale.

Take Advantages of State Colleges

Whatever the motive that prompts the desire to learn more about poultry raising, there are

many that haven't the first idea as to how to go about getting the desired knowledge, and, sad to relate, there are many that don't want to take the time to get this knowledge, believing that it is an easy thing to make a "go of it" with chickens. My advice to those who are contemplating going into the poultry business in order to make a living from it—and not just for the fun of it—is to get this knowledge and experience, in some way similar to the method to be outlined, before starting a farm.

The whole system involves the spending of a little money, but it might better be spent now than to lose it later and have nothing to show for it except a lot of sad and bitter experience. The first step is to get in touch with the state college in your state and find out when a short three months' course is given, approximate cost of attending, and any other information that can be obtained. In practically every case, I believe, the tuition is free to residents of the state, the only expenses being board and lodging, cost of books, and whatever personal expenses may be incurred —this depends upon the individual, of course. The courses are generally given during the winter months: November to February, for example. My advice, then, is to take such a course and get as much out of this theoretical or "book learning" as possible. After this course is completed, the next step is to get a position on some good com-

mercial poultryman's place in order to get the actual experience. The longer time one can spend in this phase of the educational system, the better: if it is at all possible, a person should stay on this place for a year. He would then get experience in all branches of poultry work. Poultry raising is a highly seasonal proposition, and there are some things that cannot be learned in any other way than by doing them at the particular season at which they should be done. If it is absolutely impossible for one to spend as much time as this, six months might do, but under no circumstances should this "apprenticeship" be for a shorter period than this. By all means the year, if circumstances will permit. It must be remembered that all the money that is being paid the "apprentice" as wages is really money earned and saved, for if he were working on his own plant getting experience, he would not be getting a regular wage and would probably make lots of mistakes that would cost him dearly.

Getting a Start

We will suppose that our friend has now completed his poultry education—in a very general way, for it will be many years before he has actually completed it. But by this time he ought to know enough about it to be able to start out for himself. The next question now arising is: How shall I begin? Probably by this time any-

one with as much general poultry knowledge and experience as is outlined above has very definite ideas as to how he wants to start. He ought to have. At any rate, there are four courses open to him.

He may start in with hatching eggs. Starting in this way presupposes having incubator equipment, in addition to brooder equipment. This, of course, requires the investment of a slightly larger amount of money at the start than any other method, although hatching eggs are the cheapest form in which stock can be purchased. While such a system has its advantages, it also has its disadvantages: eggs are liable to be chilled in transit from the breeding establishment to the purchaser, a beginner has generally had very little experience in handling an incubator—one of the hardest things to do and get good results in the poultry game—and this is the busiest season of the whole year, so if the incubating can be eliminated for the first year much time can be saved for other work.

He may start in with baby chicks. This is probably the best way of starting, since no incubator equipment is necessary and therefore this much on the initial investment is saved; no previous experience is necessary in incubation, and therefore the losses that are generally suffered in artificial incubation are thus avoided; baby chicks will stand shipment better than will hatching eggs;

three weeks' time and labor can be saved by not having to bother with the incubating. Probably eight out of every ten people that start in the poultry business start in this way.

He may start in with squab pullets. Squab pullets are pullets about ten to twelve weeks of age, shortly after having been weaned from heat. They are more expensive than either hatching eggs or chicks: eggs will cost about ten cents apiece, chicks will cost nearly twice that—real good ones will cost more—and squab pullets will cost around $1.25, $1.50 or even $2.00. However, when a person buys these young pullets, he doesn't have to take any of the risk in incubating or brooding them. The other fellow takes that. Therefore, no incubating or brooding equipment is needed, and thus there is a saving here in investment. Another advantage is that one does not have to wait so long for a cash return as with eggs or chicks. This fact makes this method adaptable to summer starting, instead of early spring as is the case when a start is made with eggs or chicks. It also makes a very good way of overcoming the results of a bad hatch, provided, of course, he is able to find someone in a hurry who will have enough squab pullets to spare. Naturally, if his order has been booked up early in the season, he need not worry.

He may start in the fall with mature pullets, ready to lay. This is the most expensive way of

starting, as the breeder from whom they were bought must be paid for the risk he has run in the incubation and brooding and rearing, as well as feeding these birds so long, in addition to making a profit from them. Birds at this age sell at anywhere from $2.50 to $3.00. This method, of course, is ideal for fall starting, as there is practically no wait at all before there is an income, whereas with the other methods there is. There are not many, however, who can afford to begin in this way, if they have to make a living from the business, as the investment is so heavy. This is a very good way of starting, though, if one has the money to put into it.

Cost of Starting

In order that some comparison may be had of the costs of starting in any of the above mentioned ways, I am giving the approximate costs. These figures may not hold good for all conditions—being high in some cases and low in others—but they will serve to show the relative costs. In all cases the numbers of eggs, chicks, or adult birds figured on are to produce a flock of 100 pullets. Let us take them up in order:

Hatching Eggs

500 hatching eggs	@ .10	$ 50.
Incubator, 2 250-egg machines	@ $65.	130.
Brooder		25.
House		75.

Fuel—oil for incubator and coal for brooder		5.
Feed—hatching time to maturity		90.
Total		$375.

$50. may be deducted from the above for the sale of broilers.

Baby Chicks

300 chicks	@ .20	$ 60.
Brooder		25.
House		75.
Fuel—coal for brooder		4.
Feed—hatching time to maturity		90.
Total		$254.

$50. may also be deducted here for the sale of broilers.

Squab Pullets

100 squab pullets	@ $1.50	$150.
Feed for 12 weeks		45.
Total		$195.

Mature Pullets

100 mature pullets	@ $3.00	$300.

The hatching egg method, on the face of it, would seem to be the most expensive, but it must be considered that the most equipment is needed here and that this can be used the following year and several years after, whereas with any of the other methods the equipment must be bought if any incubating is to be done the next year—and it should be. To any of these figures given above must be added the cost of the laying house for the adult birds. This may be obtained by allowing $2.25 per bird, or a cost of $225.

In addition to the above, certain small tools and equipment must be bought. This list is given

below but no attempt is made to give individual prices, owing to different conditions obtaining in different places. An approximate total cost of the entire list is given, however. The list follows:

Wheel barrow	Round pointed shovel
Spray pump	Scoop shovel
Small wooden mash hoppers (6)	Long handle manure fork
Water pans (6)	Hammer
Hoe	Screw driver
Rake	Pliers
Square pointed shovel	Pails (6)

The total cost may be itemized as follows:

Stock	$195.	—	$375.
Laying house	225.	—	225.
Small equipment	50.	—	50.
Total	$470.	—	$650.

If the cost of the land is to be figured in, an additional $2.00 per bird must be added. Remember, these figures are for starting with 100 adult birds in the fall, i. e., working up to that—by either buying them outright or buying eggs or chicks in the spring. Local prices, quality of stock and material, and the man who does the buying will undoubtedly affect these prices considerably. It's all in getting a good start, and I believe the man who buys a place with nothing on it but a dwelling house has a wonderful opportunity to build an excellent plant—if he has the poultry knowledge and experience in back of him, and the right kind of stuff in him.

APPENDIX

APPENDIX

List of Experiment Stations and Agricultural Colleges

Alabama	Station and College	Auburn
	Station	Uniontown
	Station and School	Tuskegee Institute
Arizona	Station and College	Tucson
Arkansas	Station and College	Fayetteville
California	Station and College	Berkeley
Colorado	Station and College	Fort Collins
Connecticut	Station	New Haven
	Station and College	Storrs
Delaware	Station and College	Newark
Florida	Station and College	Gainesville
Georgia	Station	Experiment
	College	Athens
Idaho	Station and College	Moscow
Illinois	Station and College	Urbana
Indiana	Station and College	La Fayette
Iowa	Station and College	Ames
Kansas	Station and College	Manhattan
Kentucky	Station and College	Lexington
Louisana	Station and College	University Station, Baton Rouge
	Station	Calhoun
Maine	Station and College	Orono
Maryland	Station and College	College Park
Massachusetts	Station and College	Amherst
Michigan	Station and College	East Lansing

Minnesota	Station and College.....	University Farm St. Paul
Mississippi	Station and College.....	Agricultural College
Missouri	Station and College.....	Columbia
	Station	Mountain Grove
Montana	Station and College.....	Bozeman
Nebraska	Station and College.....	Lincoln
Nevada	Station and College.....	Reno
New Hampshire	Station and College.....	Durham
New Jersey	Station and College.....	New Brunswick
New Mexico ...	Station and College.....	State College
New York	Station and College.....	Ithaca
	Station	Geneva
North Carolina .	Station and College	West Raleigh
North Dakota ..	Station and College	Agricultural College
Ohio	Station	Wooster
	College	Columbus
Oklahoma	Station and College	Stillwater
Oregon	Station and College	Corvallis
Pennsylvania ...	Station and College	State College
Rhode Island ..	Station and College	Kingston
South Carolina .	Station and College	Clemson College
South Dakota ..	Station and College	Brookings
Tennessee	Station and College	Knoxville
Texas	Station and College	College Station
Utah	Station and College	Logan
Vermont	Station and College	Burlington
Virginia	Station and College	Blacksburg
Washington	Station and College	Pullman
West Virginia ..	Station and College	Morgantown
Wisconsin	Station and College	Madison
Wyoming	Station and College	Laramie

LIST OF LEADING POULTRY JOURNALS

American Poultry Journal, 523 Plymouth Court, Chicago, Ill.
Canadian Poultry Review, 184 Adelaide St. West, Toronto.
Everybody's Poultry Magazine, Hanover, Pa.

Poultry Item, Sellersville, Pa.
Poultry Press, York, Pa.
Reliable Poultry Journal, Quincy, Ill.
Rhode Island Red Journal, Waverly, Iowa.

FARM JOURNALS OR SUBURBAN PAPERS WHICH CONTAIN VALUABLE POULTRY INFORMATION

Country Gentleman, Independence Square, Philadelphia, Pa.
Farm and Fireside, 381 Fourth Ave., New York, N. Y.
Farm Journal, Philadelphia, Pa.
The Field, 2 West 45th St., New York, N. Y.
Michigan Farmer, 1632 Lafayette Boulevard, Detroit, Michigan.
Ohio Farmer, 1011–1015 Oregon Ave. N. E., Cleveland, O.
Pennsylvania Farmer, 261–263 So. Third St., Philadephia, Pa.
The Rural New Yorker, 333 West 30th St., New York, N. Y.
System on the Farm, 2 West 45th St., New York, N. Y.

MANUFACTURERS OF VARIOUS KINDS OF POULTRY EQUIPMENT

Brooders—Coal Burning

Eureka—James R, Wotherspoon, Inc., Sinking Springs, Pa.
Magic—United Brooder Co., 344 Pennington Ave., Trenton, N. J.
Newtown—Newtown Incubator Co., Harrisonburg, Va.
Prairie State—Prairie State Incubator Co., 116 Main St., Homer City, Pa.
Standard—Buckeye Incubator Co., 700 Euclid Ave., Springfield, O.
Queen—Queen Incubator Co., Lincoln, Neb.

Brooders—Electric

Electric Brooder—Mailwin Manufacturing Co., 804 Eastlake Ave., Seattle, Wash.
Electric Brooder Heater—Joseph Lemke, 18 Burr Oak Ave., Melrose Park, Ill.
Success Electric Brooder Heater—Wisconsin Poultry Equipment, 1430 Junction Ave., Racine, Wis.

Brooders—Oil Burning

Buffalo—Buffalo Incubator Co., Buffalo, N. Y.
Buckeye—Buckeye Incubator Co., 700 Euclid Ave., Springfield, O.
Newtown—Newtown Incubator Co., Harrisonburg, Va.
Reliable—Reliable Incubator and Brooder Co., Quincy, Ill.
Sol Hot—H. M. Sheer Co., Quincy, Ill.
Wishbone—American Incubator Manufacturing Co., Hamilton St., New Brunswick, N. J.

Caponizing Instruments

S. K. Burdin, 120 Stibbard Ave., Toronto, Ont., Canada.

Chick Feeding Equipment

American Pans—*American Poultry Journal,* 523 Plymouth Court, Chicago, Ill.
Better Products Co., 900 Broadway St., Columbus, Wis.
Hodgkins Poultry Supply House, 1009 So. Salina St., Syracuse, N. Y.
Hoeft and Co., Inc., 406 No. Ashland Ave., Chicago, Ill.
Keipper Cooping Co., 1401 First St., Milwaukee, Wis.
McCurdy Manufacturing Co., Ada, O.
Monarch Co., Inc., Webster City, Iowa.
Mor-Kik—Milton Liggett, Seymour, Iowa.
Oakes Manufacturing Co., 331 Dearbirn St., Tipton, Ind.
Norwich Automatic Feeder Co., 7 Trumbull St., New London, Conn.
410 Washington St., St. Louis, Mo.
Geo. E. Conkey Co., Cleveland, O.
Otto Weiss Milling Co., Wichita, Kan.

Disinfectants

Carbola—Carbola Chemical Co., Inc., 299 Ely Ave., Long Island City, N. Y.
Carbolineum—Carbolineum Wood Preserving Co., Milwaukee, Wis.
Creola—Chemo Co., Chemo Building, Buffalo, N. Y.
Chemo " " " " " " "
Soluble Pine " " " " " " "

Zenoleum—Zenner Products Co., Zenner Building, Detroit, Mich.

Egg Cartons

Self-Locking Carton Co., 515–517 East Illinois St., Chicago, Ill.

W. A. Schurmann and Co., 365–409 East Illinois St., Chicago, Ill.

Egg Testers

Perfect Egg Tester—C. Lingemann, 3110 Elliott Ave., St. Louis, Mo.

Searchlight Egg Tester—F. W. Dobbel, Sonoma, Cal.

Electric Lighting Units

Delco Light Co., Dayton, O.

Lally Light Corporation, Detroit, Mich.

Western Electric Co., 110 William St., New York, N. Y.

Excelsior Egg Case Pads

Atlantic Excelsior Manufacturing Co., 507 W. 30th St., New York, N. Y.

Feed Hoppers and Fountains

Bolgiano's Supply House, Baltimore, Md.

Keyes-Davis Co., Hanover St., Battle Creek, Mich.

Jacobus Waste-Not Hopper—M. R. Jacobus, Ridgefield, N. J.

Rockford Poultry Supply Co., Rockford, Ill.

Incubators—Mammoth

Buckeye (Cabinet)—Buckeye Incubator Co., 700 Euclid Ave., Springfield, O.

Candee—Candee Incubator Co., Eastwood, N. Y.

Newtown—Newtown Incubator Co., Harrisonburg, Va.

H. M. Sheer, Co., Quincy, Ill.

Wishbone—American Incubator Manufacturing Co., Hamilton St., New Brunswick, N. J.

Incubators—Small

Buckeye—Buckeye Incubator Co., 700 Euclid Ave., Springfield, O.

Buffalo—Buffalo Incubator Co., Buffalo, N. Y.
Ironclad Incubator Co., Racine, Wis.
Old Trusty—M. M. Johnson, Co., Clay City, Neb.
Prairie State—Prairie State Incubator Co., 116 Main St., Homer City, Pa.
Queen—Queen Incubator Co., Lincoln, Neb.
Reliable—Reliable Incubator and Brooder Co., Quincy, Ill.
H. M. Sheer Co., Quincy, Ill.
Wishbone—American Incubator Manufacturing Co., Hamilton St., New Brunswick, N. J.

Knock-Down Houses

Fox Lumber Co., Vineland, N. J.
E. F. Hodgson Co., 71 Federal St., Boston, Mass.
Potter and Co., 14 Forest Ave., Downers Grove, Ill.
E. C. Young Co., Randolph, Mass.

Leg Bands—Celluloid and Metal

Aluminum Marker Works, Beaver Falls, Pa.
American Poultry Supply Co., 499 Main St., Canton, Mo.
Bartel's Poultry Supply House, New York, N. Y.
Bourne Manufacturing Co., 231 Howard St., Melrose, Mass.
Cadwallader Manufacturing Co., Box 901, Salem, O.
Eureka Supply House, Mount Morris, Ill.
Illinois Band and Supply Co., 238 So. Lincoln Ave., Chicago, Ill.
Keyes Davis Co., Hanover St., Battle Creek, Mich.
National Poultry Band Co., Newport, Ky.
H. O. Shaw, Grinnell, Iowa.
Stumpp and Walter, 52 Barclay St., New York, N. Y.
Arthur P. Spiller, Beverly, Mass.
Superior Leg Band—Aurora Band Co., 80 La Salle St., Aurora, Ill.

Parcel Post Egg Carriers

Anderson Box Co., Anderson, Ind.
Brower Manufacturing Co., Grafton, Ill.
Edgerton Manufacturing Co., Plymouth, Ind.
Keipper Cooping Co., 1401 First St., Milwaukee, Wis.

Metal Egg Crate Co., 325 Wolfe St., Fredericksburg, Va.
Premier Egg Box—Western Box and Basket Co., Box 1044, Omaha, Neb.
Surety Egg Box Co., Hohkus, N. J.
U. S. Pulp Products Corporation, Newark, N. Y.
John C. Vanderoef, Montgomery, N. Y.
Wright Box Co., Farmingdale L. I., N. Y.

Rat Virus

Gold Seal Laboratories, 3842 W. Lake Ave., Chicago, Ill.
Imperial Laboratories, 2110 Grand Ave., Kansas City, Mo.
Virus Ltd., 121 W. 15th St., New York, N. Y.

Shipping Boxes—Baby Chicks

Anderson Box Co., Anderson, Ind.
Keipper Cooping Co., 1401 First St., Milwaukee, Wis.
Pratt Food Co., Philadelphia, Pa.

Wire Pedigree Baskets

Progressive Wire Goods Co., Williamstown, N. J.

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